

FUEL SYSTEM GENERAL DESCRIPTION

The fuel tank on all 1969 Cadillac cars is mounted against the lower surface of the trunk compartment with two support straps.

The fuel tank capacity is approximately 26 US gallons (21.75 Imperial gallons) on all models except the Fleetwood Eldorado, which has a 24 gallon (20 Imperial gallons) capacity fuel tank and Commercial Chassis, which has a 20 gallon (16.75 Imperial gallons) capacity fuel tank.

Service information pertaining only to those features that are exclusive to the Eldorado fuel system is included at the end of this section beginning on page 8-6.

NOTE: The gasoline filler cap is located behind the rear license mounting plate, which is the filler door. The hinged plate swings out from the top. The filler pipe is an integral part of the fuel tank on all cars except the 697 and 698 series.

The filler cap is a NON-VENTED type on all models. A vent pipe is located at the front of the tank to allow air to enter the tank as gasoline is used.

The tank unit for the gasoline gage is mounted near the top center of the fuel tank. It contains the float unit, which is connected to the gage unit on the instrument panel by one wire, with another wire to ground. The fuel outlet line is integral with the tank float unit assembly. It has a special plastic filter (water separator) on the inlet end. The filter has a self-cleaning action, provided by the sloshing action of the gasoline.

The fuel outlet line is attached to the gage assembly on the top center of the tank and extends along the inside of the right frame side rail and the front of the front suspension cross member to the fuel pump, Fig. 8-1.

SERVICE INFORMATION

1. Storage Precautions

Whenever a car is to be put in storage for 30 days or longer, all gasoline should be drained from the fuel system, including the carburetor, fuel pump, lines and tank. This must be done to assure freedom from gum deposits that would occur due to evaporation of the fuel.

2. Fuel Tank Removal and Installation (Except 693)

NOTE: When working on or around the fuel tank always have a CO₂ fire extinguisher near the work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce a spark in the area.

a. Removal

1. Disconnect fuel gage tank wire at connector at right of filler cap behind license plate door. This is the brown wire to the lower connector. Pull wire down past rear frame member from underside of car.
2. Siphon fuel from tank.
3. Raise car.
4. Disconnect fuel outlet hose at front of tank.
5. If car is equipped with air conditioning, disconnect vapor return hose.
6. Disconnect vent pipe from rear floor pan.
7. Disconnect fuel gage tank unit ground wire at rear frame cross member.

8. Remove tank support strap nuts and remove tank.

CAUTION: Be careful tank does not damage or dent brake piping on axle housing.

b. Installation

1. Raise tank into position and install tank support straps and nuts. Make sure fuel gage tank unit wire and ground wire hang over tank.
2. Tighten tank strap nuts until 2 inch to 2-3/16 inch of thread is exposed on bottom of J-bolts. On Fleetwood Seventy-Fives, run nut below notch and break off notched end of J-bolt. Be careful not to overtighten tank strap nuts.
3. Connect fuel outlet hose.
4. If car is equipped with air conditioning, connect vapor return pipe.
5. Connect vent to floor pan.
6. Route brown fuel gage tank unit wire over rear cross member and up to right of filler pipe. Secure to lower right connector.
7. Connect tank unit ground wire to frame.
8. Lower car, add gasoline to tank and check for leaks at vent pipe, fuel line, and vapor return line.
9. Check operation of fuel gage.

3. Fuel Line and Tank Cleaning

Occasionally it may be necessary to clean out fuel line and tank to remove foreign particles

from system. Frequent replacement of fuel filters and excessive deposits of dirt in the fuel inlet strainer are indications that this may be necessary.

To clean out fuel line, disconnect line at fuel pump and at fuel tank, blow compressed air through the line in direction opposite to fuel flow, and reconnect line.

For cleaning, fuel tank must be removed from car, and flushed out to remove all foreign materials. Fuel strainer also should be inspected and replaced if necessary, on all styles except 693, which does not have a replaceable strainer in the fuel tank. It may be necessary, in some cases, to replace the fuel tank on 693 style cars.

4. Fuel Line (Except 693)

NOTE: When working on or around the fuel lines, always have a CO₂ fire extinguisher near the work area. In addition, do not permit smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Raise car.
2. Remove clips that secure fuel line to inside

of right frame side rail. Then remove one clip at frame where it ramps upward at front, two clips at front suspension cross member, one clip at front frame extension and one clip on rear suspension cross member. A dual clip is used to hold fuel and vapor return lines.

3. Remove hose clamps, one at front, and one at rear of, fuel line. Remove fuel line from hoses.

4. Plug hoses to prevent fuel loss.

b. Installation

1. Unplug hoses.

2. Position fuel line, connect hoses, and install hose clamps.

3. Install clips that secure fuel line to inside of right frame side rail. Then install one clip at frame where it ramps upward at front, two clips at front suspension cross member, one clip at front frame extension and one clip on rear suspension cross member. If car is equipped with air conditioning, larger diameter fuel line should be installed above vapor return line along frame side rail.

4. Check both fuel line connections.

5. Check lines for stabilizer bar clearance at front, and for axle clearance at rear and install lines in body clip at rear.

EXHAUST SYSTEM GENERAL DESCRIPTION

NOTE: Service information pertaining only to those features that are exclusive to the Eldorado exhaust system is included at the end of this section, beginning on page 8-6.

The exhaust system on all Cadillac cars, except the Eldorado incorporates (in order from front to rear), a crossover Y-exhaust pipe, an intermediate pipe, a muffler, a muffler-to-resonator pipe, and a resonator, Fig. 8-1. On the Sixty Special, Fleetwood Seventy-Five, and Com-

mercial Chassis, a longer intermediate pipe is used because of the additional length of these vehicles.

The components of the exhaust system are supported by slide and blade-type hangers, clamps, and brackets, and are insulated at attaching points by rubber cushions. These supports are designed to keep the system in proper alignment to avoid contact with the frame and body, even when the system is hot and expanded. The system must not be bound up or restricted

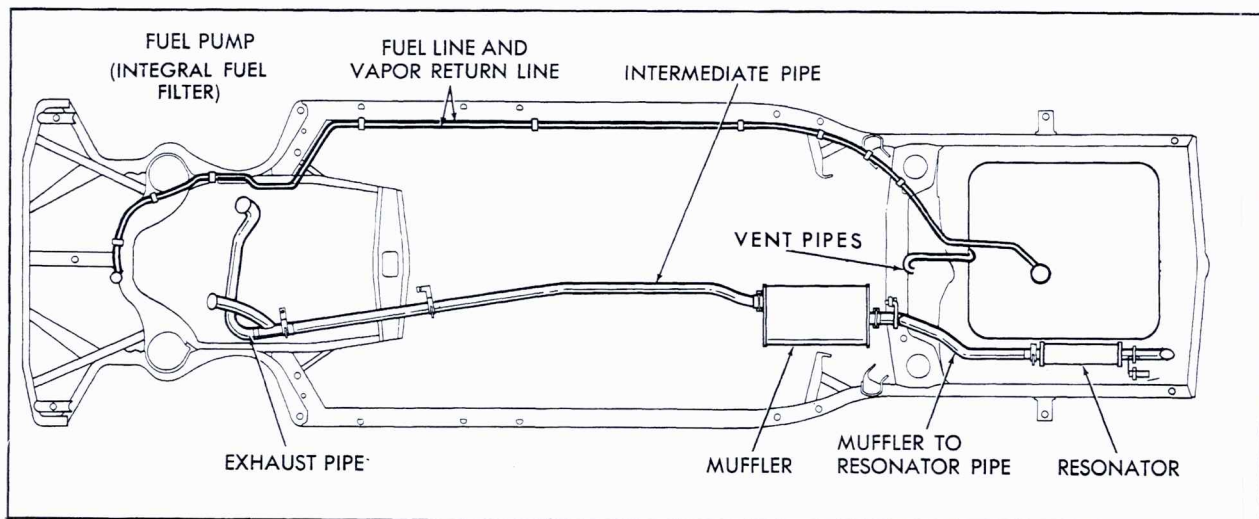


Fig. 8-1 Fuel Tank and Exhaust System

if the noise reduction benefits are to be fully realized.

The thermostatically controlled heat valve is located at the junction of the right exhaust manifold and exhaust pipe. It controls the flow of exhaust gases from the right cylinder head. During the engine warm-up period, the valve is closed, forcing the hot exhaust gases through a ribbed heat passage in the intake manifold to heat the intake manifold and improve the air-fuel mixture.

A branch of this passage conducts exhaust gases up to the carburetor. These hot gases warm the carburetor in the region of the primary throttle valves and idle ports to prevent stalling due to ice formation during engine warm-up on cool, humid days.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

5. Manifold Heat Control Valve

a. Removal

1. Raise car.
2. Loosen intermediate pipe hanger at transmission extension housing.
3. Remove nuts securing exhaust pipe to left and right manifolds.
4. Allow exhaust pipe to rest on steering linkage.
5. Remove two stud bolts from right exhaust manifold.
6. Remove manifold heat control valve.
7. Remove metal gasket.

b. Installation

1. Install a new metal gasket on the heat valve.
2. Position heat control valve against right manifold with weight upward and inboard toward engine.
3. Install two stud bolts into manifold, holding heat control valve and gasket in place. Tighten studs to 35 foot-pounds.
4. Raise exhaust pipe against manifolds and secure with nuts. Tighten nuts to 30 foot-pounds.
5. Tighten intermediate pipe hanger at transmission extension housing, Fig. 8-2, to 25 foot-pounds.
6. Lower car.

6. Exhaust Pipe (Except 693)

NOTE: Have a CO₂ fire extinguisher near work area when using heat.

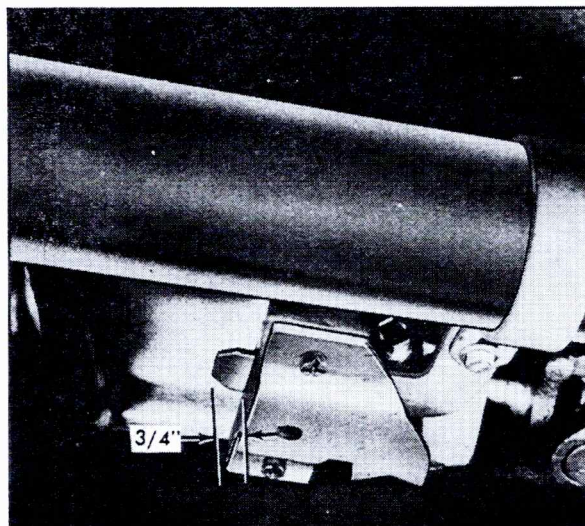


Fig. 8-2 Intermediate Pipe Hanger at Transmission

a. Removal

1. Raise car.
2. Loosen intermediate pipe hanger at transmission extension housing.
3. Remove lateral Y pipe brace at transmission housing.
4. Remove two nuts securing pipes to each exhaust manifold.
5. Remove clamp securing exhaust pipe to intermediate pipe.
6. Allow exhaust pipe to drop and drive exhaust pipe forward out of intermediate pipe. Use heat as required.

b. Installation

1. Insert exhaust pipe into intermediate pipe so that pipes overlap up to branch weld on pipe, approximately 2-1/8 inches.
2. Raise exhaust pipe and secure to manifolds. Align system and tighten nuts to 30 foot-pounds.
3. Secure exhaust pipe and lateral pipe brace to intermediate pipe with clamp. Position clamp so that saddle of clamp is 1/8 inch in from edge of pipe and nuts point upward, Fig. 8-3. Leave nuts loose.
4. Install lateral Y pipe brace to transmission housing and tighten nut to 15 foot-pounds.
5. Align system and tighten clamp nuts to 50 foot-pounds.
6. Tighten intermediate pipe hanger at transmission extension housing to 25 foot-pounds.
7. Check alignment as explained in Note 11, and adjust as necessary.
8. Lower car.

7. Intermediate Pipe

NOTE: Have a CO₂ fire extinguisher near work area when using heat.

a. Removal

1. Raise car.

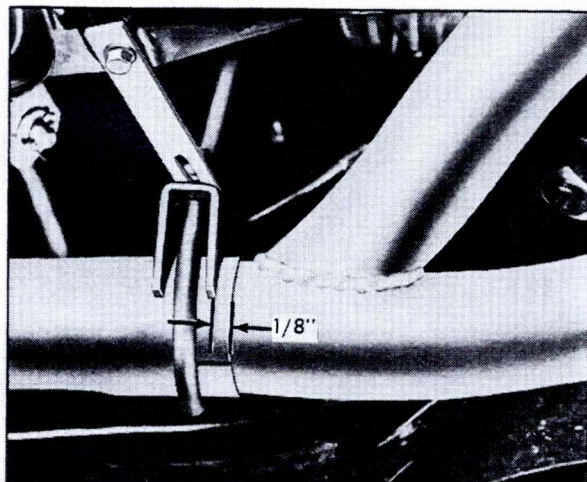


Fig. 8-3 Intermediate Pipe at Exhaust Pipe

2. Loosen resonator hanger clamp and remove hanger blade.
3. Remove clamp securing muffler to intermediate pipe.
4. Slide muffler off intermediate pipe. Use heat as required.
5. Remove clamp securing intermediate pipe to exhaust pipe.
6. Loosen lateral Y pipe brace at transmission housing.
7. Slide intermediate pipe rearward, disengaging blade from hanger at transmission, and pipe from exhaust pipe. Use heat as required.
8. Remove hanger blade from intermediate pipe.

b. Installation

1. Loosely install hanger blade on intermediate pipe.
2. Slide intermediate pipe over exhaust pipe so that intermediate pipe overlaps exhaust pipe up to branch weld approximately 2-1/8 inches.
3. Secure intermediate pipe to exhaust pipe with clamp. Position clamp with saddle of clamp 1/8 inch from end of pipe and upward, Fig. 8-3. Leave nuts loose.
4. Tighten lateral Y pipe brace at transmission housing to 15 foot-pounds.
5. Insert intermediate pipe into muffler approximately 1-1/2 inches. Position clamp with saddle of clamp 1/8 inch in from edge of pipe toward left side of car, Fig. 8-4. Tighten nuts to 30 foot-pounds.
6. Install resonator hanger and clamp. Align system and tighten to 10 foot-pounds.
7. Align system and tighten muffler clamp nuts to 35 foot-pounds and exhaust pipe clamp nuts to 50 foot-pounds.
8. Install blade of hanger into slot of hanger at transmission extension housing so that blade of hanger sticks out 3/4 inch from slot, Fig. 8-2. Tighten hanger blade to 25 foot-pounds.
9. Check alignment as explained in Note 11 and adjust as necessary.
10. Lower car.

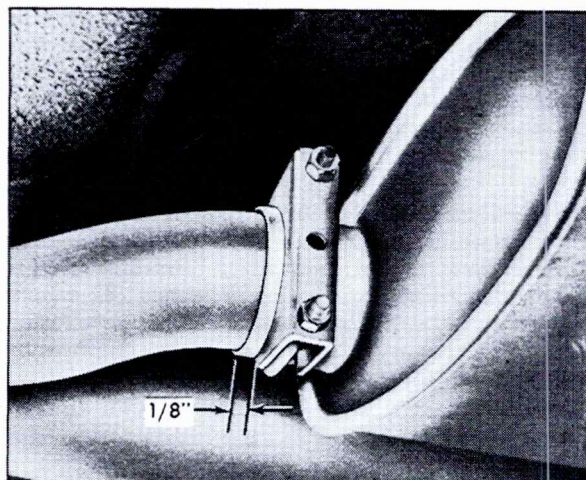


Fig. 8-4 Intermediate Pipe to Muffler Clamp

8. Muffler (Except 693)

NOTE: Have a CO₂ fire extinguisher near work area when using heat.

a. Removal

1. Raise car.
2. Loosen resonator hanger clamp and remove hanger blade.
3. Remove two nuts securing front clamp to muffler and remove front clamp.
4. Remove two nuts securing rear clamp to muffler and remove clamp.
5. Slide rear portion of exhaust system back off intermediate pipe. Use heat as required.
6. Drive muffler off muffler-to-resonator pipe. Use heat as required.

b. Installation

1. Position muffler onto muffler-to-resonator pipe so that muffler outlet overlaps pipe approximately 1-1/2 inches.
2. Insert intermediate pipe into muffler inlet approximately 1-1/2 inches.
3. Install muffler-to-resonator pipe clamp. Position clamp with saddle of clamp 1/2 inch in from edge of pipe and toward left side of car, Fig. 8-5. Tighten nuts to 30 foot-pounds.
4. Engage resonator outlet hanger blade and muffler-to-resonator pipe hanger blade with slots in hangers so that blades stick out from hangers 3/4 inch, Fig. 8-5 and 8-6.
5. Secure muffler to intermediate pipe and resonator with clamps. Position clamp with saddle of clamp 1/8 inch in from edge of pipe and toward left side of car, Fig. 8-4. Tighten nuts to 35 foot-pounds.
6. Check alignment as explained in Note 11 and adjust as necessary.
7. Lower car.

9. Resonator (Except 693)

a. Removal

1. Raise car.

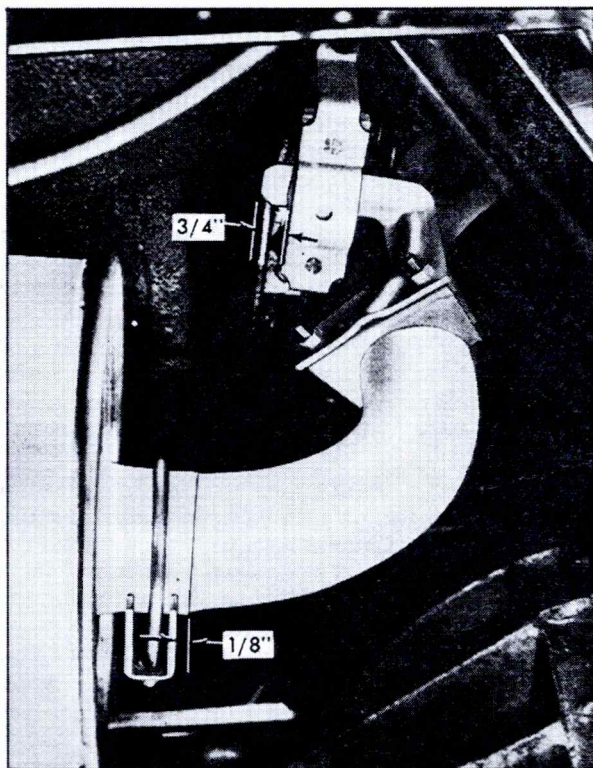


Fig. 8-5 Muffler-to-Resonator Pipe Clamp and Hanger

2. Remove two nuts securing clamp at joint of resonator to muffler-to-resonator pipe, and remove clamp.

3. Remove rear exhaust hanger at resonator outlet.

4. Separate resonator from muffler-to-resonator pipe.

CAUTION: Do not use heat behind rear axle due to presence of fuel vapors.

b. Installation

1. Loosely install hanger blade on resonator outlet pipe.

2. Position resonator on muffler-to-resonator pipe approximately 1-1/2 inches.

3. Secure resonator to pipe with clamp. Position saddle of clamp 1/8 inch in from edge of

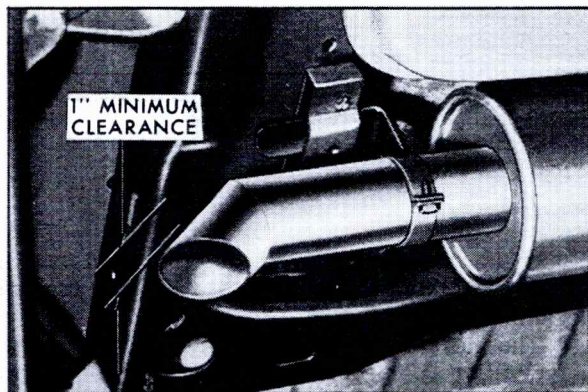


Fig. 8-6 Resonator Outlet Pipe Hanger

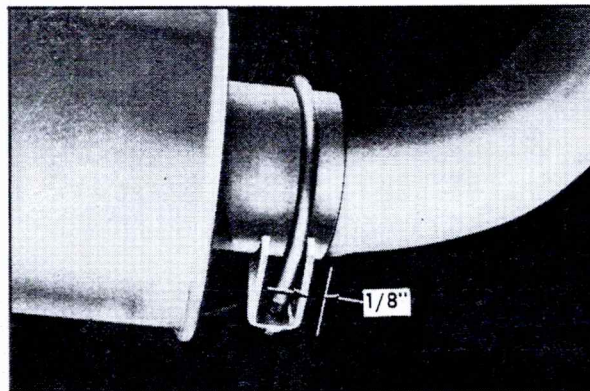


Fig. 8-7 Muffler to Resonator Pipe Clamp

pipe and toward left side of car, Fig. 8-7. Tighten nuts to 30 foot-pounds.

4. Position blade of hanger into slot of hanger so that blade sticks out one inch from slot, Fig. 8-6. Tighten blade-to-pipe clamp to 10 foot-pounds.

5. Check alignment as explained in Note 11 and adjust as necessary.

6. Lower car.

10. Muffler-To-Resonator Pipe

NOTE: Have a CO₂ fire extinguisher near work area when using heat.

a. Removal

1. Remove resonator as described in Note 9a.

2. Remove clamp securing pipe to muffler outlet.

3. Drive pipe out of muffler outlet. Use heat as required.

4. Disengage pipe from hanger at kick-up area and remove pipe from car.

5. Remove hanger blade from pipe.

b. Installation

1. Loosely install hanger blade on pipe.

2. Position pipe on car and engage hanger blade into slot of hanger.

3. Insert pipe into muffler outlet approximately 1-1/2 inches and secure with clamp. Position clamp with saddle of clamp 1/8 inch in from edge of pipe and toward left side of car, Fig. 8-5. Tighten nuts to 35 foot-pounds.

4. Position blade of hanger so that blade sticks out 3/4 inch from slot, Fig. 8-5, and tighten blade to pipe. Tighten nuts to 15 foot-pounds.

5. Install resonator as described in Note 9b.

11. Exhaust System Alignment (Except 693)

NOTE: Exhaust system should be properly aligned to avoid contact with frame. Blade-type exhaust system hangers are designed to minimize noise transfer through hangers. If system contacts frame or blade is bound up or restricted, vibration and noise can be transmitted into car.

Position clamps and blades so that hanger blades are horizontal and centered from side to side in the rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone lubricant should be applied in rubber slots of brackets.

CAUTION: Do not use petroleum base products such as grease, on the rubber parts.

If it is necessary to reposition pipes, heat may be used in front of rear axle. Allow pipes to cool before touching them. Do not use acetylene torch behind rear axle due to presence of fuel tank fumes. Have CO₂ fire extinguisher near the work area.

1. Raise car.

2. Loosen clamps located at resonator end, muffler ends, clamp and blade at transmission extension housing, "kick-up" area and resonator outlet.

3. Make certain system is horizontal and has adequate clearance at transmission mounting support. At the transmission extension housing hanger, Fig. 8-2, the blade should be centered from side to side and horizontal in rubber slot of support hanger. It must not bind when system expands. The support blade should be parallel with the transmission housing bracket. Support hanger should be horizontal. A small amount of silicone lubricant should be in rubber slot of the hanger. End of blade should stick out approximately 3/4 inch from bracket, Fig. 8-2.

4. Position intermediate pipe to exhaust pipe so there is approximately 1/8 inch between saddle of clamp and edge of intermediate pipe, Fig. 8-3. Tighten clamp to 50 foot-pounds.

5. Position clamp between intermediate pipe and muffler so there is approximately 1/8 inch between edge of muffler inlet pipe and saddle of clamp, Fig. 8-4. Tighten clamp just enough to prevent separation. Then check alignment of remainder of exhaust system.

6. Position clamp between muffler outlet pipe and muffler-to-resonator pipe so there is approximately 1/8 inch between edge of muffler outlet pipe and saddle of clamp, Fig. 8-5. There should be approximately 1-1/2 inch overlap of outlet pipe with muffler-to-resonator pipe.

7. Align resonator on muffler-to-resonator pipe so there is a minimum of one inch between outlet pipe and rear frame cross member, when measured perpendicular to the angle of pipe at outlet, Fig. 8-6.

8. Position clamp between muffler-to-resonator pipe so there is 1/8 inch between saddle of clamp and edge of resonator inlet pipe, Fig. 8-7.

9. Check entire system again to see that there is adequate clearance with frame and body members - at least one inch (except 1/2" at frame rear cross member). The weight of the exhaust system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger rubber. If the load is not properly balanced, reposition the pipes at the joints to relieve concentrated loads on any hangers.

10. After adjusting hangers or repositioning pipes, recheck the entire system for adequate clearance to frame members and tighten all clamps according to torques specified at the end of this section.

11. Lower car.

TORQUE SPECIFICATIONS (Except 693)

Material Number	Application	Thread Size	Foot-Pounds
286-M	Exhaust Pipe to Manifold Nuts	3/8-24	30
300-M	Exhaust Manifold Stud Bolts	3/8-24	35
286-M	Muffler and Resonator Clamp Nuts.	3/8-16	35
286-M	Intermediate Pipe to Exhaust Pipe Clamp Nuts.	7/16-14	50
6010-M	Intermediate Pipe Hanger Screw at Transmission Extension Housing .	5/16-18 x 1-1/4	25
286-M	Lateral Y Pipe Brace Nut at Transmission Housing.	3/8-16	15
6010-M	Resonator Outlet Pipe Hanger Screw.	No. 20-9 x 1-1/2	10

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.

FLEETWOOD ELDORADO FUEL SYSTEM GENERAL DESCRIPTION

NOTE: The following information pertains only to those features that are exclusive to the Eldorado fuel system.

The fuel tank on the 1969 Fleetwood Eldorado coupe Fig. 8-8, is mounted against the lower surface of the trunk compartment with two sup-

port straps. The capacity of this fuel tank is approximately 25 U.S. gallons (20 Imperial gallons).

The gasoline filler cap is accessible through a fuel filler door located at the center of the lower edge of the deck lid. This door swings upward from the bottom. The filler pipe is attached to the

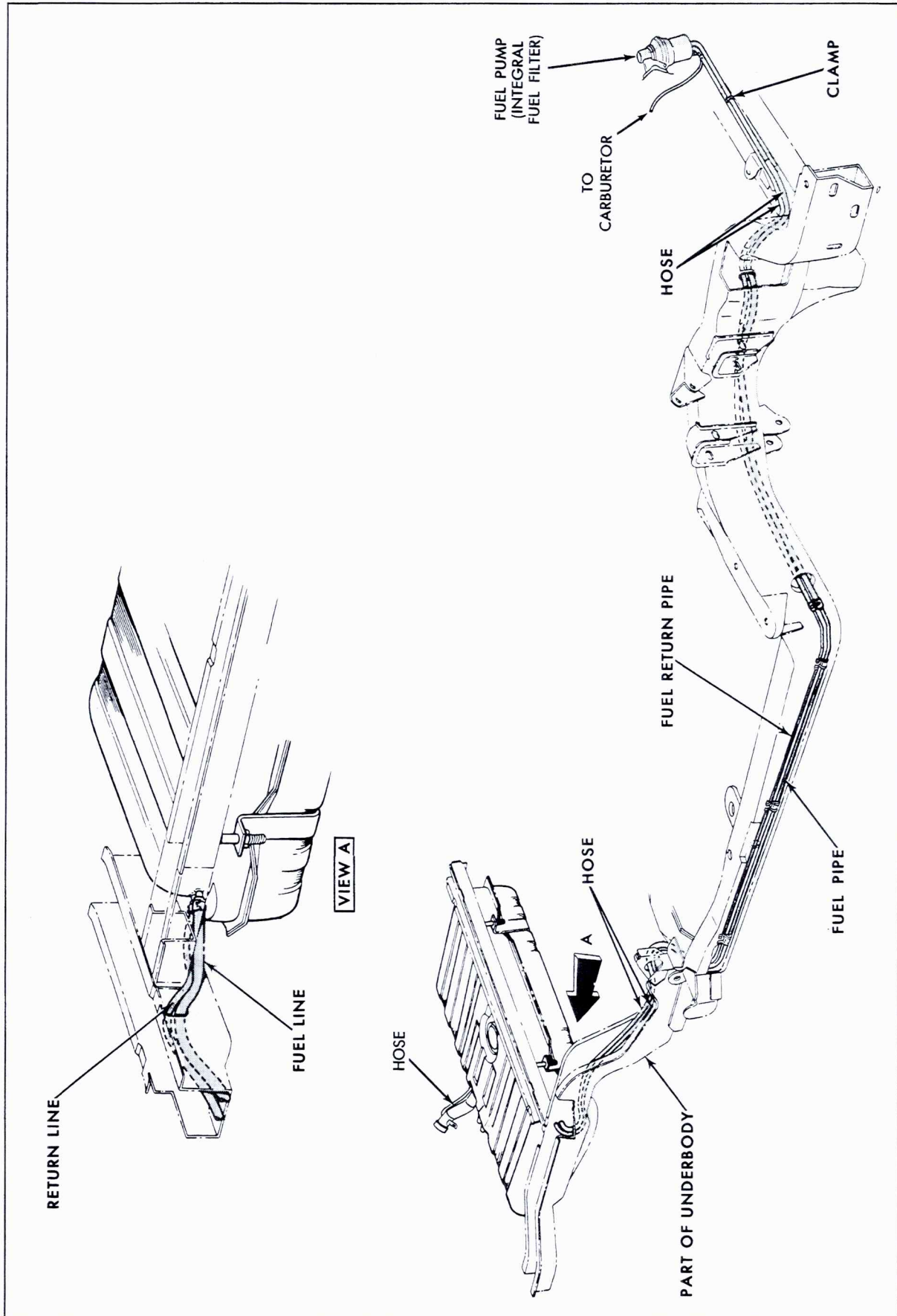


Fig. 8-8 Eldorado Fuel System

tank at the rear center through a flexible hose. The vent pipe is located next to the filler pipe and connects into the filler pipe just below the cap. A VENTED cap is used on the Eldorado to

allow air to enter the tank as gasoline is used. A secondary vent is located at the front of the tank and is routed into the right hand rear wheel shock tower area.

SERVICE INFORMATION

12. Fuel Tank Removal and Installation—Eldorado Only

NOTE: When working on or around the fuel tank, always have a CO₂ fire extinguisher near work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Open trunk. Remove eight screws securing filler panel and remove filler panel.
2. Disconnect fuel gage tank wire behind rear bumper. This is the brown wire to connector at rear of body. Pull wire down under car.
3. Syphon fuel from tank.
4. Raise car.
5. Loosen clamp at lower ends of filler pipe and vent pipe flexible connectors.
6. Disconnect fuel outlet hose at front of tank.
7. If car is equipped with air conditioning, disconnect vapor return hose at front of tank.
8. Remove fuel gage tank unit ground wire at rear body cross member.
9. Remove tank support strap nuts and remove tank.
10. With tank partially removed disconnect secondary vent line hose.

CAUTION: Be careful tank is not damaged by muffler or resonator.

b. Installation

1. Raise tank into position and connect secondary vent line hose.
2. Install tank support straps and nuts. Make sure fuel gage tank unit wire and ground wire hang over-tank.

NOTE: Do not tighten tank strap nuts until filler pipe is installed.

3. Position filler pipe in place so that clamp engages bead on pipe. Tighten clamps to 20 inch-pounds.
4. Tighten tank strap nuts so that 1 1/4 inches of thread are exposed below the nuts.
5. Connect fuel outlet hose.
6. If car is equipped with air conditioning, connect vapor return line.

7. Route brown wire up to connector at back of body and install it in connector.

8. Connect tank unit ground wire to rear body cross member.

9. Lower car. Add gasoline to tank, and check for leaks at filler pipe, vent pipe, fuel line, and vapor return line. Make certain secondary vent hose does not sag.

10. Check operation of fuel gage.

11. Install filler panel and secure with eight screws.

13. Fuel Line—Eldorado Only

NOTE: When working on or around the fuel lines, always have a CO₂ fire extinguisher near the work area. In addition, do not permit smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Raise car.
2. Remove clamps securing flexible fuel line to fuel tank outlet and to fuel pump, and disconnect lines at these points.
3. Tie a piece of cord to the flexible fuel lines for installation purposes.
4. Remove three clips securing fuel line to outside surface of right frame side rail.
5. Carefully remove fuel lines from car, leaving cord in place on car.
6. Remove clamps securing flexible fuel line to fuel pipe and separate.

b. Installation

1. Connect flexible fuel line to steel fuel pipe and secure with clamps. Hoses should overlap steel line one inch.
2. Position fuel pipe to outside surface of right frame side rail and secure with three clips.
3. Tie cords left in car to ends of flexible fuel lines and carefully pull fuel lines to tank and engine.
4. Remove cord.
5. Connect flexible lines at tank and engine and secure with clamps.
6. Lower car.

FLEETWOOD ELDORADO EXHAUST SYSTEM GENERAL DESCRIPTION

NOTE: The following information pertains only to those features that are exclusive to the Eldorado exhaust system.

The exhaust system on the 693 body style, Fig. 8-9 consists of two exhaust pipes, a muffler, and a resonator. The system is supported to the

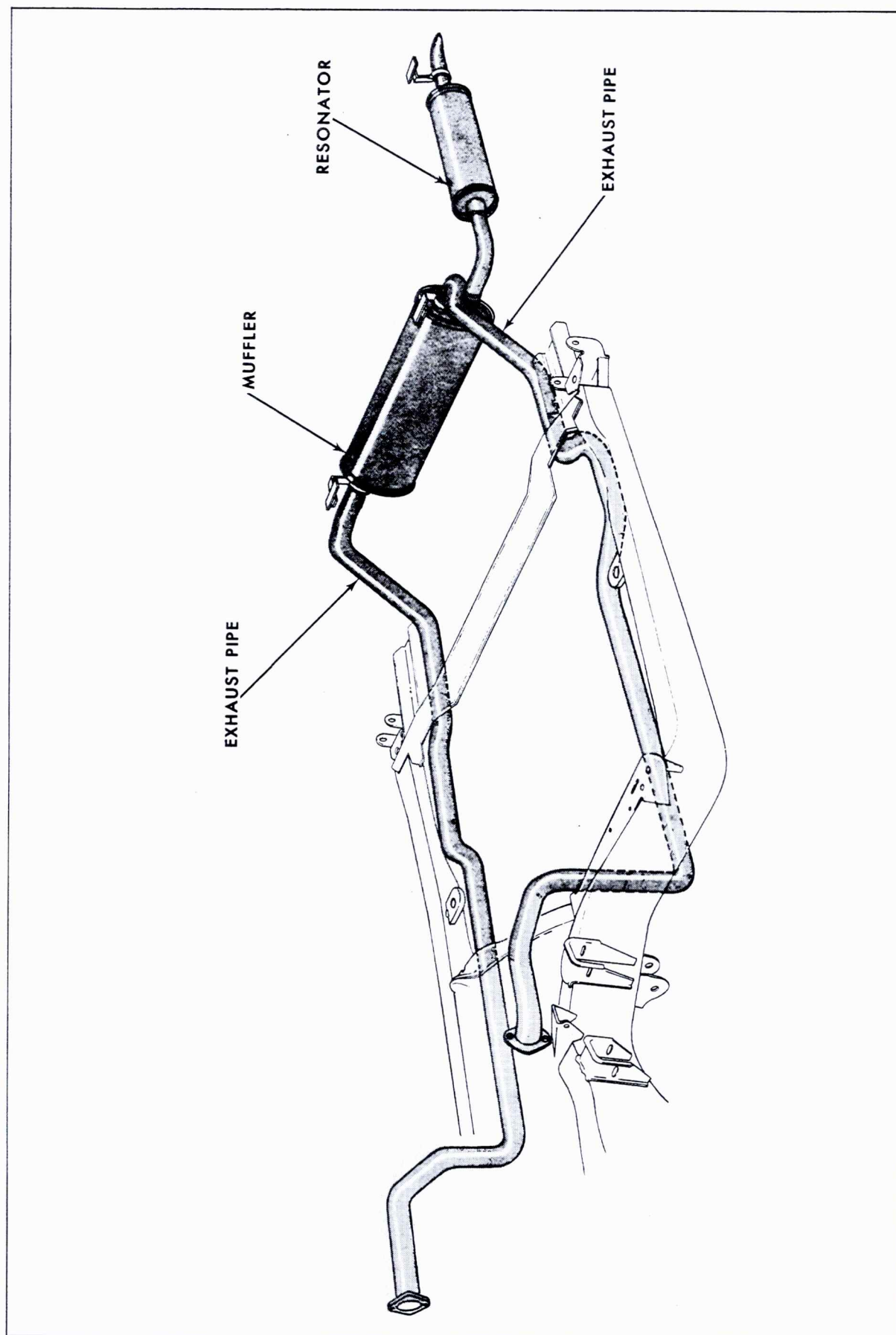


Fig. 8-9 Eldorado Exhaust System

rear body by blade-type hangers at three points: two where the exhaust pipes enter either end of the muffler and one on the resonator outlet. The forward portion of the system is supported by its connection to the exhaust manifolds.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders

is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

SERVICE INFORMATION

14. Exhaust Pipe—Eldorado Only

a. Removal

1. Loosen clamp securing exhaust pipe to muffler.
2. Drive exhaust pipe out of muffler.
3. Cut exhaust pipe at weld in pipe and remove rear portion of pipe.

NOTE: Have a CO₂ fire extinguisher near the work area when using heat.

4. Remove two screws securing left pipe flange to manifold or two nuts securing right pipe flange to manifold.

5. Remove forward portion of pipe.

b. Installation

1. Position pipe and flange to manifold and loosely install retaining screws, left side, or nuts, right side.
2. Position pipe clamp loosely around forward portion of pipe.
3. Insert rear portion of pipe into forward portion of pipe so that pipes overlap approximately 1-1/2 inches. Loosely install clamp with saddle of clamp outboard of system and 1/8 inch between saddle of clamp and edge of pipe.
4. Insert rear end of pipe into muffler so that muffler overlaps pipe approximately 1-1/2 inches.
5. Align system as described in Note 17 and tighten clamps to 20 foot-pounds.

15. Resonator—Eldorado Only

NOTE: Do not use acetyline torch behind rear axle due to presence of fuel tank fumes.

a. Removal

1. Raise car.
2. Remove clamp securing resonator inlet at muffler.
3. Remove screws securing resonator outlet hanger to body and remove hanger.
4. Remove resonator assembly by driving inlet out of muffler.
5. Remove resonator hanger blade from resonator outlet pipe.

b. Installation

1. Loosely install resonator hanger blade on resonator outlet.
2. Position resonator inlet into muffler outlet

so that muffler overlaps resonator inlet approximately 1-1/2 inches.

3. Position resonator outlet hanger on blade and secure hanger to body with screws, Fig. 8-10.

4. Position clamp on joint of resonator inlet and muffler outlet with saddle of clamp 1/8 inch from end of muffler outlet, Fig. 8-10.

5. Align rear portion of exhaust system as described in Note 17. Tighten pipe clamp to 20 foot-pounds and resonator support clamp to 10 foot-pounds.

16. Muffler—Eldorado Only

NOTE: Do not use acetylene torch behind rear axle due to presence of fuel tank fumes.

a. Removal

1. Raise car.
2. Loosen clamp securing resonator inlet at muffler.
3. Remove screws securing resonator hanger to body and remove hanger.
4. Remove resonator assembly.
5. Remove right exhaust pipe to muffler clamp and hanger.
6. Remove left exhaust pipe to muffler clamp and hanger, and carefully lower muffler downward until exhaust pipes rest on rear axle.

CAUTION: Care should be taken not to

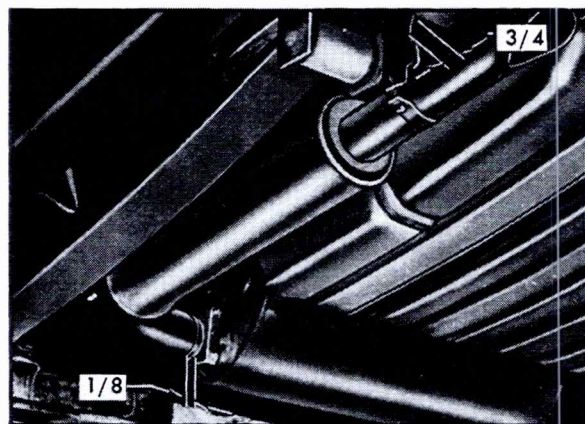


Fig. 8-10 Eldorado Resonator

damage brake piping or air leveling components on the axle.

7. Secure right exhaust pipe to leaf spring in such a manner that system cannot shift to the left, Fig. 8-11.

CAUTION: The spring should be padded to protect it from damage.

8. Drive muffler off right exhaust pipe.
9. Repeat steps 7 and 8 on the left side.

b. Installation

1. Position left exhaust pipe into muffler, approximately 1-1/2 inches.
2. Position right exhaust pipe into muffler with approximately 1-1/2 inch overlap of pipes.
3. Position right exhaust pipe to muffler clamp so there is 1/8 inch between saddle of clamp and muffler.
4. Connect right exhaust clamp to hanger blade and loosely install nuts.
5. Repeat steps 3 and 4 for left clamp and hanger.
6. Position resonator inlet into muffler up to inlet, approximately 1-1/2 inch overlap of pipes.

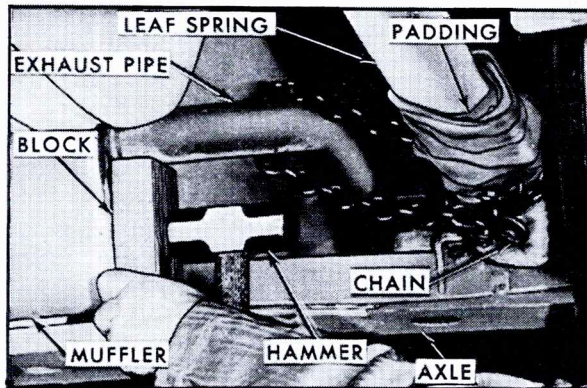


Fig. 8-11 Eldorado Muffler Removal

7. Position resonator hanger blade in its slot and secure hanger to body with screws, Fig. 8-10.

8. Install muffler to resonator clamp at muffler, Fig. 8-10.

9. Align system as described in Note 17 and tighten clamps to 20 foot-pounds.

17. Alignment—Eldorado Only

Position clamps and blades so that hanger blades are horizontal and centered from side to side in rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone should be applied in rubber slots of brackets. The hangers must not bind when exhaust system expands.

CAUTION: Do not use petroleum base products, such as grease, on the rubber parts.

1. Raise car.
2. Loosen clamps located at muffler ends.
3. Check muffler hangers. Ends of hangers should stick out 3/4 inch from brackets. The muffler should overlap all pipes approximately 1-1/2 inch. The clamps should be positioned with 1/8 inch between the saddle of clamps and muffler pipes.
4. Make certain that resonator is horizontal and that it has a minimum of 3/4 inch clearance from fuel tank and 7/8 inch clearance from rear leaf spring. The resonator outlet hanger blade should be centered from side to side and horizontal in rubber slot of support hanger. It must not bind when system expands. A small amount of silicone lubricant should be in rubber slot of hanger. Blade of hanger should stick out 3/4 inch from bracket, Fig. 8-10.
5. The entire system should be checked to see that there is adequate clearance to frame and body members, at least 13/16 inch. The weight of the system should be evenly distributed on all three brackets and hangers as indicated by an equal deflection at each hanger. If load is not properly balanced, reposition the pipes at the joints to relieve any concentrated loads.
6. After adjusting hangers or repositioning pipes, recheck entire system for adequate clearance and tighten all clamps according to torques specified at the end of this section.
7. Lower car.

TORQUE SPECIFICATIONS (693 ONLY)

Material Number	Application	Thread Size	Foot-Pounds
Special	Exhaust Pipe to Manifold Nuts	3/8 -24	30
286-M	Clamp Attaching Nuts	5/16-18	20
6010-M	Resonator Outlet Pipe Screw	20-9	10

GENERAL DESCRIPTION

Service information pertaining only to those features that are exclusive to the Eldorado steering is included at the end of this section, beginning on page 9-53.

The power steering system used on 1969 Cadillac cars utilizes a variable ratio steering gear (16.0:1 on center, 12.2:1 at full turn, except on Fleetwood Seventy-Five sedans, limousines and commercial vehicles, which use a constant ratio gear (17.5:1).

The steering gear is mounted on the left frame side rail and is secured by three mounting screws. The gear is joined to the steering shaft by a flexible coupling that reduces the transmission of hydraulic valve noises and road shock to the car interior.

A constant displacement vane type pump provides hydraulic pressure for the steering system. The pump is located on the left front corner of the engine, Fig. 9-1 and is belt driven by an engine crankshaft pulley.

On cars equipped with air conditioning, two belts are used on the power steering pump pulley. On cars without air conditioning, one belt is used.

A power steering pump cooler is used on 1969 cars equipped with air conditioning. The cooler compensates for the slightly higher temperatures on air conditioner equipped cars and protects the rubber components of the system from excessive temperatures under extreme operating conditions.

The steering pump cooler is located on the underside of the radiator cradle support.

Steering Linkage (Except 693)

The steering linkage, Fig. 9-2 consists of a pitman arm, idler arm and bracket, two tie rod

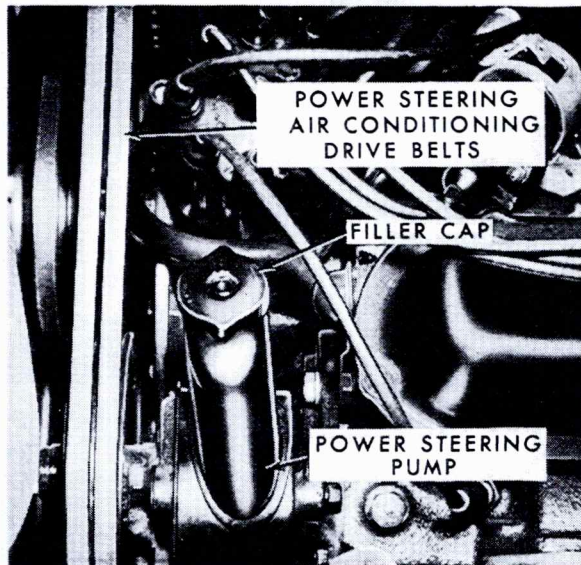


Fig. 9-1 Steering Pump Location

assemblies, and a one-piece forged steel drag link. The pitman arm connects the left side of the drag link to the steering gear and the idler arm and bracket assembly connect the right side of the drag link to the frame. The tie rods serve as connecting links between the drag link and steering arms.

The tie rod adjuster tubes are lubricated at assembly to make toe-in adjustment easier during front wheel alignment. The adjuster tubes should be re-lubricated with chassis lubricant if disassembled from the tie rods for any reason.

All 1969 cars are fitted with replaceable tie rod end seals. The seals should be inspected at each engine oil change for signs of physical damage. Special spherical joint lubricant should be used when a seal is replaced. If a tie rod pivot is loose, the complete pivot assembly must be replaced.

Steering Gear

The major internal components of the variable ratio steering gear are the rotary valve assembly, steering worm, rack-piston assembly, and the pitman shaft, Fig. 9-3. The movement of these parts, while turning or parking, is aided by hydraulic pressure supplied by the pump. Manual steering is always available at times when the engine is not running, or in the event of pump failure. Steering effort is increased under such conditions.

The steering input shaft, hydraulic valve, worm shaft, and rack-piston assembly are all "In line". The rack-piston in the variable ratio steering gear is modified to accommodate the larger center tooth on the pitman shaft gear, Fig. 9-3. All oil passages are internal within the gear housing, except for the pressure and return hoses between the gear and the pump.

The mechanical element of this steering gear is a low-friction, recirculating ball system, in which steel balls act as a rolling thread between the steering worm and the rack-piston. The one-piece rack-piston assembly is geared to the sector of the pitman shaft.

The hydraulic rotary valve is concentric with the input shaft and is contained in the upper section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar allows the spool to rotate in relation to the valve body, thereby operating the valve.

Under normal driving conditions the steering wheel effort will range from 1 to 1 1/2 pounds, and parking effort will range from 2 to 2 1/2 pounds.

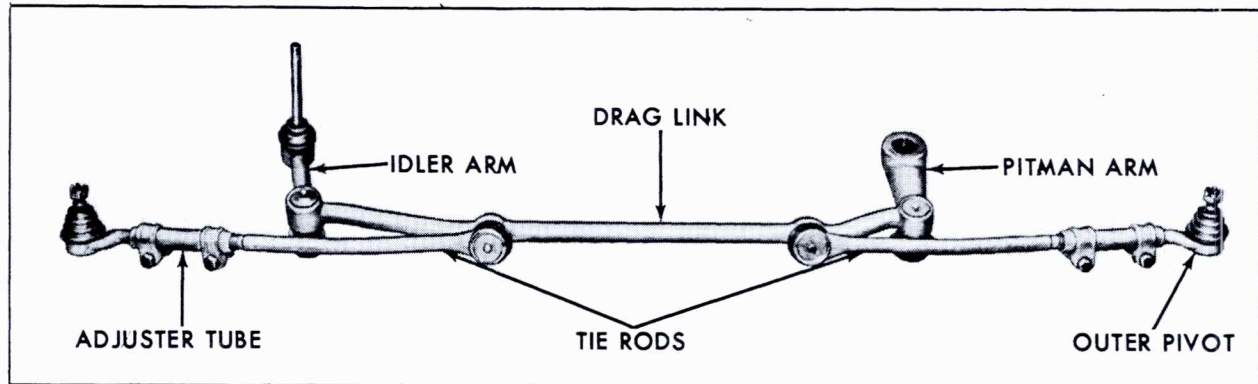


Fig. 9-2 Steering Linkage

Steering Pump

The major components of the power steering pump are the oil reservoir, drive shaft, pump housing, cam ring, pressure plate, thrust plate, flow control valve, and rotor and vane assembly, Fig. 9-4. The pump housing and component parts are encased in the oil reservoir. The reservoir filler cap has a dipstick attached to show the oil level in the reservoir.

There are two bore openings at the rear of the pump housing. The larger of these openings contains the cam ring, pressure plate, thrust plate,

rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve, and spring. The flow control orifice is part of the pressure line union. A pressure relief valve inside the flow control valve limits pump pressure to 1350-1450 psi.

Energy Absorbing Steering Column (Fig. 9-5)

The steering columns used on Cadillac automobiles are of the energy absorbing type. The outer jacket consists of two tubes of different

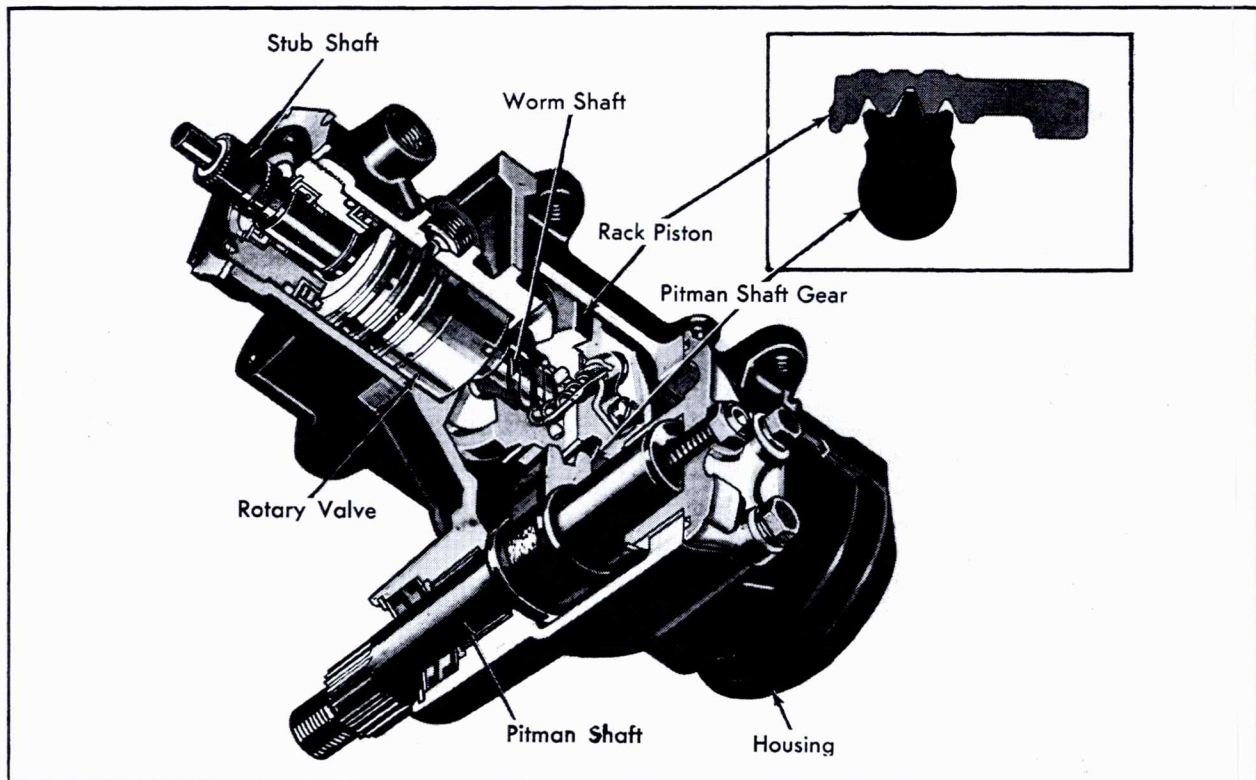


Fig. 9-3 Steering Gear Cutaway

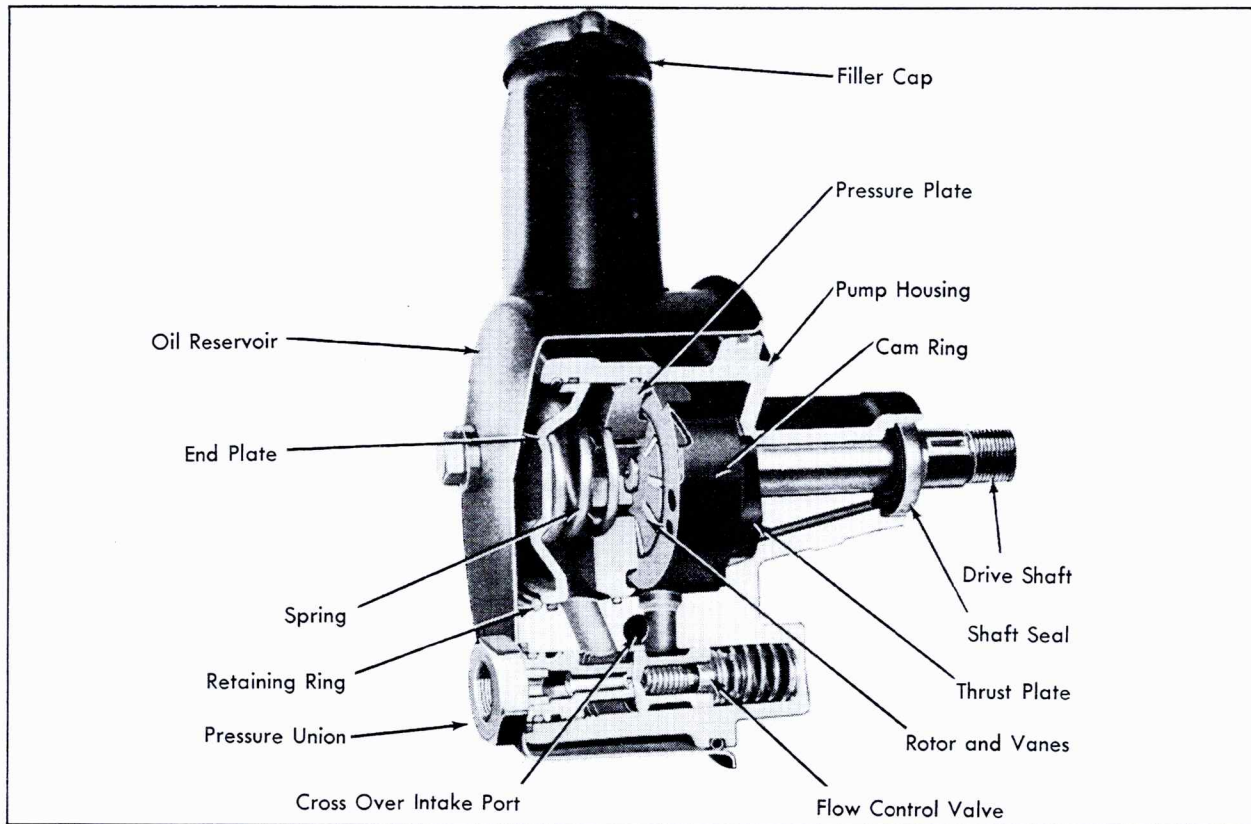


Fig. 9-4 Steering Pump Cutaway

diameters joined together by two rows of ball bearings (16 balls per row) that are pressed into position. During impact, the ball bearings roll along the jacket wall allowing the smaller, lower end of the jacket to collapse within the larger upper end. The steering shaft is constructed in two parts fitting together so that they can telescope. The shift tube is constructed in two telescoping parts. A plastic joint holds the telescoping parts of both the steering shaft and the shift tube so that they remain in the proper relationship under normal operation.

The column is supported in the car at the upper mounting position by a bracket containing two release capsules. If an excessive impact load acts on the upper end of the column, the upper mount release capsules will shear and allow the column to collapse downward.

This column must be handled and serviced with extreme care so that the sections are not mispositioned. Observe the following precautions:

Use only the specified screws, bolts and nuts during reassembly.

CAUTION: Do not use bolts longer than specified at the upper mounting bracket to jacket attachment, as they may prevent the column assembly from collapsing during impact.

Equally important is the correct torquing of all nuts and bolts. Follow exactly the torque recommendations given in every step.

At no time should the column, shift tube, or steering shaft be struck from either end with a hammer, or pulled excessively. Care must be taken never to let the column drop when removing or installing.

Tilt and Telescope Steering Column (Figs. 9-6 and 9-51)

The Tilt and Telescope steering column consists of a steering shaft with a universal joint, adjusting and locking mechanism for tilt adjustment; a telescoping upper shaft and yoke assembly, and locking mechanism for telescopic adjustment. These adjustments are made independently of each other.

The up and down tilt action is achieved by pulling upward on a small lever located on the left side of the steering column just below the directional signal lever, moving steering wheel to one of six desired angles, then releasing lever to lock wheel in position. If no pressure is applied to the steering wheel when tilt lever is actuated, the steering wheel automatically raises to a higher position.

Two upward and three downward positions are possible in the tilt mechanism in addition to the normal driving position. These six positions cover a range of 25 degrees in 5 degree steps as shown in Fig. 9-6.

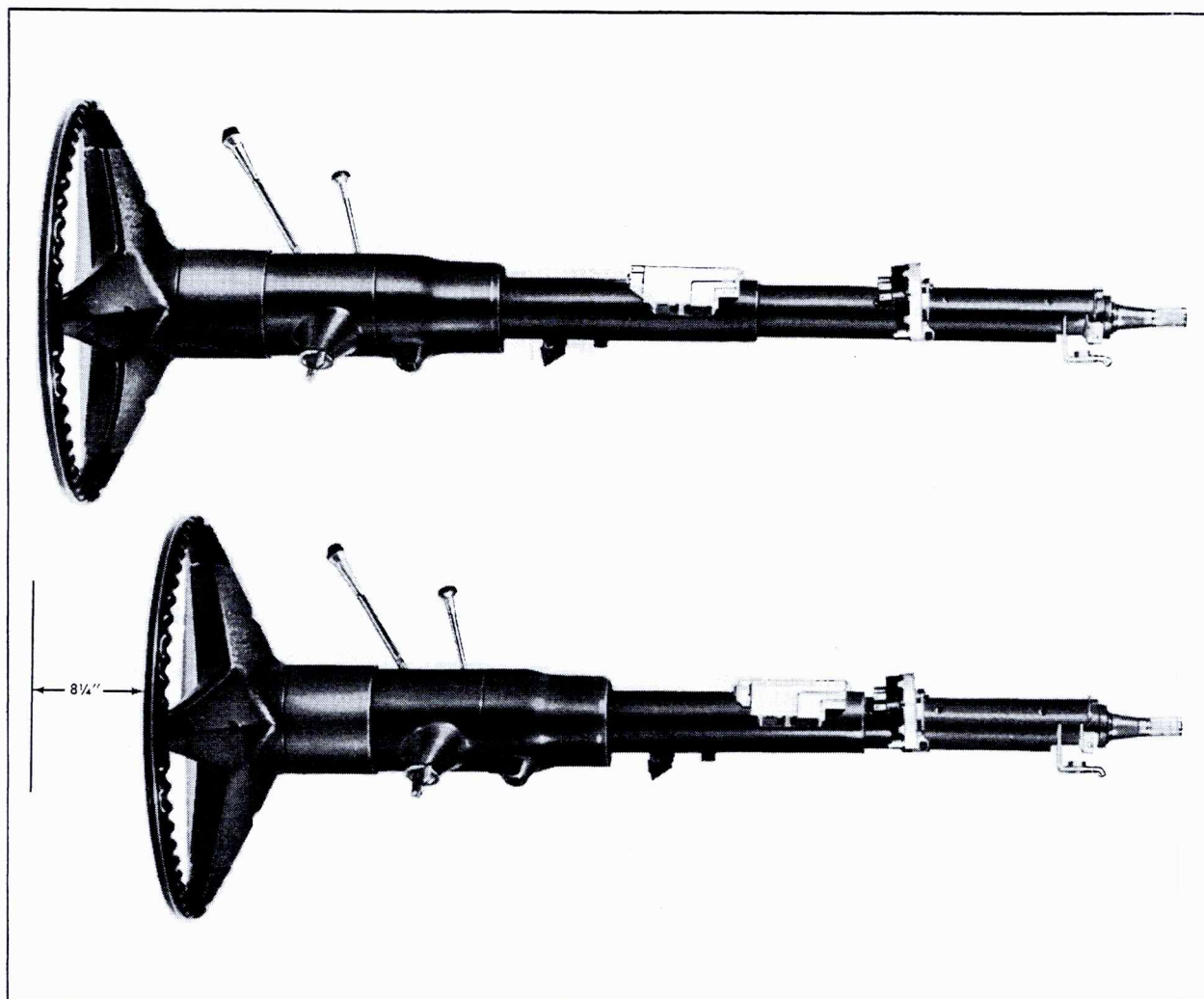


Fig. 9-5 Energy Absorbing Steering Column

Two lock shoes regulate the degree of tilt. Grooves in the lock shoes engage pins to lock the unit in position when the tilt lever is released.

The telescoping mechanism permits adjustment of the distance between the driver and the wheel to an infinite number of positions within a 2-3/4 inch range.

This adjustment is made by rotating the steering column locking lever counterclockwise to unlock the telescoping mechanism, positioning the wheel for the desired distance, and locking the telescoping mechanism by turning the locking lever clockwise.

The three spoke steering wheel features a "rim-blow" device for sounding the horn. The horn control extends all the way around the inside rim of the steering wheel. Pressing lightly with your fingers on the soft, vinyl surface on the inside of the rim blows the horn. The lead wire is connected to the spring support on the underside of the steering wheel. A coiled spring which expands and contracts when the wheel is telescoped connects the lead wire with the lower contact assembly.

The coiled spring rides upon a horn wire clip and spring assembly located in the turn signal housing. The horn wire is attached to the chassis wiring harness through a connector.

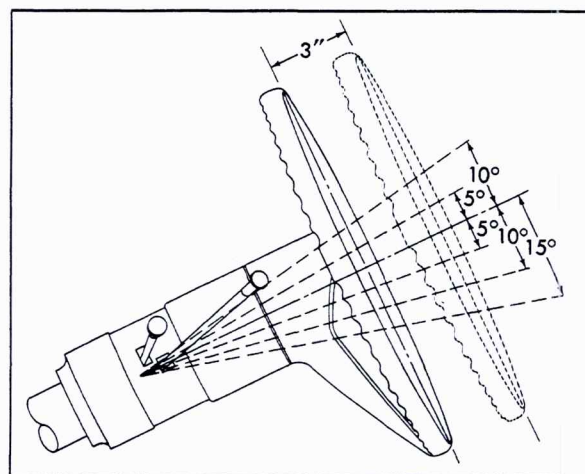


Fig. 9-6 Tilt and Telescope Steering Wheel

The horn, hazard warning and turn signal wiring are integral components of the turn signal housing assembly, and are serviced as an assembly.

The turn signal cancelling cams are located on the reverse side of the horn contact carrier assembly, and the turn signal, cornering light and hazard warning switches are located within the column. A wire harness for the turn signal lights, cornering lights and stop lights runs from the instrument panel harness to the switches.

SERVICE INFORMATION

Four factors affect power operation of the steering system: fluid level and condition, drive belt tension, pump pressure and steering gear adjustment. These should always be checked before any major service operations are performed.

Conditions such as hard or loose steering, road shock, or vibrations are not always due to steering gear or pump, but are often related instead to such factors as low tire pressure or front end alignment. These factors should be checked and corrected before any adjustment of the steering gear is made.

1. Checking Fluid Level

1. Run engine and turn gear from lock to lock three or four times, then shut engine off. Remove reservoir filler cap and check oil level on dipstick. Level should be between "Full" mark and end of dipstick when fluid is approximately 150 degrees (reservoir is hot to touch).

2. If oil level is below end of dipstick, add special power steering fluid to "Full" mark on dipstick and replace filler cap.

NOTE: When adding or making a complete fluid change, always use special power steering fluid available from servicing Parts Warehouses.

3. When checking fluid level after making a complete fluid change, air must be bled from the system. Proceed as follows:

- a. Raise front of car and with engine off, turn wheels all the way to the left.

- b. Add power steering fluid to "Add" mark on dipstick.

- c. Start engine and recheck fluid level. Add fluid if necessary to "Add" mark on dipstick.

- d. Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above internal pump casting. Fluid with air in it will have a light tan appearance. This air must be eliminated from fluid before normal steering action can be obtained.

- e. Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

- f. Road test car to make sure steering functions normally and is free from noise.

The upper and lower ball bearings are serviced as part of the actuator housing. The bearing preload is set by the upper bearing spring.

Service operations on the steering gear, power steering pump, and steering linkage are exactly the same on cars equipped with a Tilt and Telescope wheel as on cars with the standard wheel. Steering gear adjustments are performed in the same manner and to the same specifications. Steering column to gear alignment and steering wheel alignment also are the same.

- g. Recheck fluid level as described in steps 1 and 2, making sure fluid level is at "Full" mark on dipstick.

2. Checking Pump Pressure

1. Disconnect pressure hose at high pressure fitting on steering gear. Have container ready to catch dripping oil.

2. Connect pressure hose to Adapter, J-7786, on Gage Valve Assembly, J-5176-01, Fig. 9-7.

3. Connect pump end of an extra pressure hose to valve side of gage, and other end to high pressure fitting on steering gear.

4. Open gage valve, start engine, run at idle, and recheck oil level.

5. With car weight on front wheels, turn steering wheel slowly against right or left stop. Hold wheel against either stop to obtain maximum pressure reading. Pressure gage should read not less than 1350 psi. If pressure will not reach 1350 psi, it indicates internal leakage in the gear or a defective pump.

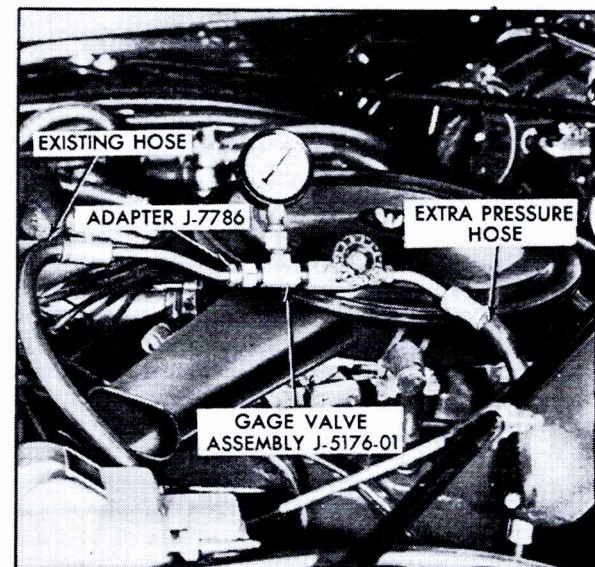


Fig. 9-7 Checking Pump Pressure

CAUTION: Never hold wheels against stops for more than 5 seconds.

6. To determine which unit is at fault, check pump output separately by slowly closing gage valve. When pressure peaks on gage, note reading and quickly open gage valve. Pressure readings should be between 1350 and 1450 psi when valve is closed.

CAUTION: Do not leave gage valve closed for more than 5 seconds or damage to pump cam ring may result.

7. If the reading does not reach the specifications in step 6, pump needs servicing.

8. If pressure rises with valve closed, pump is functioning properly, and fault is in steering gear or lines.

9. Shut off engine, remove pressure testing equipment and reconnect pressure hose to gear.

10. Recheck oil level.

3. Steering Pump Cooler

a. Removal

1. Mark cooler hoses for proper reinstallation before removing hoses from cooler.

2. Loosen steering gear-to-cooler hose and steering pump-to-cooler hose hex slotted clamp screws at cooler. Disconnect hoses.

3. Tape ends of both hoses to prevent drainage of fluid and to keep dirt from entering system.

4. Remove screw that secures cooler and remove cooler.

b. Installation

1. Position steering pump cooler and secure with screw.

2. Remove tape from ends of hoses, and connect steering pump-to-cooler hose to upper cooler tube and steering gear-to-cooler hose to lower cooler tube.

3. Tighten hex slotted clamp screws on hoses to 20 inch-pounds.

4. Checking Steering Gear Adjustments (On Car)

Before making adjustments to the power steering gear to correct conditions such as shimmy, hard or loose steering, road shock, wander or weave, a check should be made of front end alignment, shock absorbers, wheel balance, or for tight front wheel bearings, loose steering rod ends or loose pitman arm.

When steering gear is thought to be out of adjustment, a quick check can be made by moving steering wheel back and forth with short slow motions at the "on center" position with engine off. Excessive looseness felt or heard indicates that either the pitman shaft or the thrust bearing requires adjustment. These adjustments can be made on car with engine off as follows:

a. Thrust Bearing Preload Check (Just Away From the Stops)

1. Remove pitman arm from drag link, using Puller Tool, J-8990-01, Fig. 9-8. Make certain tool is positioned with puller engaging tabs on pitman arm. On 693, disconnect pitman arm from drag link as described in Note 28, steps 2, 3 and 4.

2. Check for any distortion or binding in flexible coupling. Correct as necessary, see Note 6.

3. Turn steering wheel just away from stops, and use a spring tension scale with a piece of tag wire or string to measure pull on steering wheel through an arc not exceeding one inch, Fig. 9-9. Total pull should be between 4 and 12 ounces (thrust bearing and friction).

CAUTION: Make certain string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise, inaccurate readings may result.

4. If pull is greater or less than specified, loosen adjuster plug locknut and back off adjuster plug 1/8 turn, using Spanner Wrench J-7624.

NOTE: If position of holes in adjuster plug is such that there is insufficient clearance for using Spanner Wrench, insert a #10 bolt 3/4 inch long in one of the adjuster plug holes and rotate flexible coupling until lower flange contacts bolt. Then back off adjuster plug 1/8 turn.

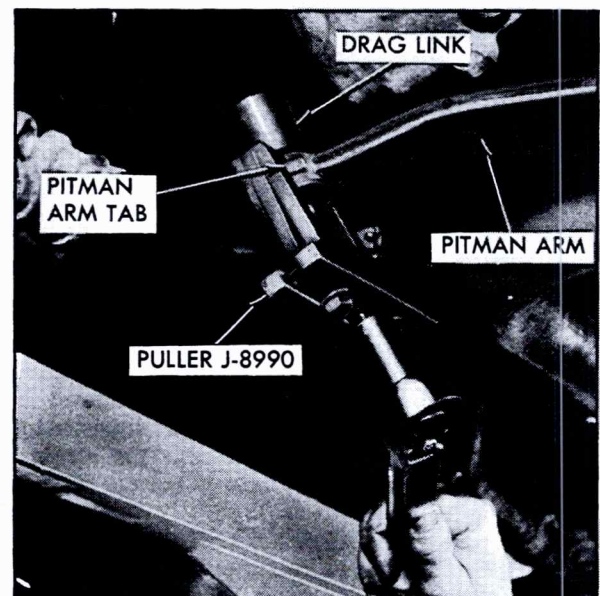


Fig. 9-8 Disconnecting Pitman Arm

5. Recheck steering "pull" with wheel just away from the stops.

6. Adjust preload by tightening adjuster plug to obtain 2 to 6 ounces (at rim of steering wheel) in excess of total drag that was just measured with adjuster plug backed-off 1/8 turn.

7. Tighten adjuster plug locknut and recheck preload to insure that plug did not move when nut was tightened.

b. Checking Worm and Ball Preload (1/2 Turn Off-Center)

1. Locate center of steering wheel travel and turn wheel 1/2 turn "off-center"

2. With wheel 1/2 turn "off-center", measure and record total pull through an arc not exceeding one inch. Due to worm and ball preload, the total pull should be from 2 to 8 ounces in excess of the pull just away from the stop previously recorded.

CAUTION: Make certain that string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise inaccurate readings may result.

3. If total pull is less than one ounce or more than 9 ounces in excess of just away from stop pull, steering gear must be removed from car and disassembled for replacement of worm shaft balls, see Note 12.

4. Check for roughness in worn and rack-piston by turning wheel between 1/4 turn and 1 turn "off-center" on each side. Noticeable roughness also requires worm replacement.

c. Checking Pitman Shaft End Play (On-Center)

1. Find exact center of steering wheel travel. Tight spot due to pitman shaft may extend for 1/4 turn to either side.

2. With wheel "on-center", measure and record total pull through an arc of three inches or less.

CAUTION: Make certain that string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise, inaccurate readings may result.

3. This reading should not be more than 36

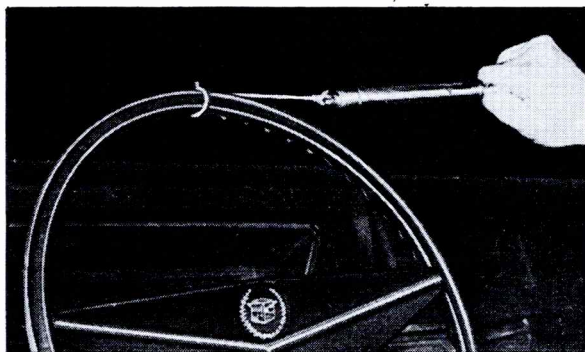


Fig. 9-9 Checking Steering Wheel Pull

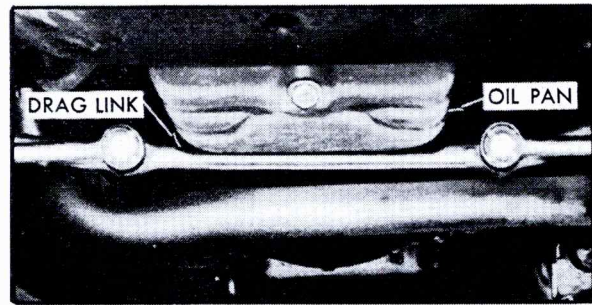


Fig. 9-10 Steering Linkage Parallelism

ounces, but should be 8 to 20 ounces more than a reading taken 1/2 turn "off-center".

NOTE: On new steering gears, the factory setting with ball bearing preloads and new seal drag may cause total pull to be as high as 40 ounces. Within the first 100 miles of operation, the seals seat themselves and the ball bearings polish the rack-piston and worm shaft grooves sufficiently to meet the service specifications.

4. If pitman shaft end play is not within limits, it should be adjusted so that "on-center" preload is 16-18 ounces more than the 1/2 turn "off-center" load but still not more than 36 ounces. Adjust on car by loosening locknut and turning adjusting screw as required. Recheck pull after tightening locknut.

5. When steering gear adjustments are completed, remove spring scale, connect pitman arm to drag link, and tighten drag link nut to 40 foot-pounds. Install cotter pin securing drag link nut. On 693, connect pitman arm to drag link as described in Note 28d.

5. Steering Linkage Parallelism

The parallelism of the steering linkage drag link should be checked in cases of steering wander and instability after the normal corrective adjustments such as standing height and front wheel alignment have been made. A quick check can be made by sighting from the front of the car with the car on a wheel alignment machine.

The drag link should appear parallel with the bottom of the engine oil pan and frame front crossmember, Fig. 9-10. If it is not, correction can be made by loosening the idler arm support bracket mounting screws on the frame side rail and adjusting the bracket to obtain the desired drag link position. Tighten the mounting screws after adjustment.

If the correction required cannot be made by this adjustment, additional correction can sometimes be obtained by tightening the pitman arm nut to a higher torque. This will move the pitman arm further onto the steering gear splined shaft.

In no case should the pitman arm or idler arm be bent to obtain the required adjustment.

6. Steering Column Alignment

NOTE: Do not raise car on hoist while aligning column as full weight of car must be on wheels for proper alignment.

1. Start engine and position front wheels in the straight ahead position for easy access to flex-coupling adjustment screws.

2. Remove steering column lower cover as described in Section 12, Note 45a.

3. Loosen screw that attaches shift pointer to right hand side of column shift bowl to avoid damage to shift pointer while adjusting column.

4. Loosen two nuts that secure upper steering column mounting bracket to upper steering column support studs.

5. On all cars except Eldorado, loosen two screws that secure lower steering column bracket to toe pan and one clamp screw securing lower steering column bracket to column. On Eldorado, loosen three screws at toe pan and one from column clamp.

6. On all cars except Eldorado, loosen one clamp screw that secures steering shaft to flex-coupling clamp. On Eldorado, loosen clamp screw securing steering extension shaft to universal joint clamp.

7. Align the steering column to the instrument panel as follows:

a. Adjust in and out position of column to instrument panel as described below:

Upper edge of column shift bowl (at column

centerline) must be the proper distance from instrument panel bezel to have correct steering wheel to driver relationship. These dimensions are:

	Except Eldorado	Eldorado
Standard Column	4 1/2"	4 5/8"
Tilt and Telescope Column	2 3/16"	2 9/16"

b. After making the above adjustment, center column within the instrument panel bezel. The bezel seal should be only slightly depressed when properly aligned. Tighten the two upper mounting bracket to support nuts (at release capsules) to 25 ft. lbs.

CAUTION: Do not exceed 25 ft. lbs. as that is maximum torque that the release capsule can withstand and still provide satisfactory release.

8. Check alignment of flex-coupling disc. The steering column and gear are correctly aligned when the rubber disc is flat and the pins are centered in the "C" slots in the upper flange. The pins should extend beyond the edges of the flange slots equally at both locations, Fig. 9-11. After alignment, tighten clamp screw to 30 foot-pounds.

9. Check shift lever for binding, squeaking or high shift feel effort. Check ignition switch and lock cylinder for proper operation. Align shift pointer and tighten screw.

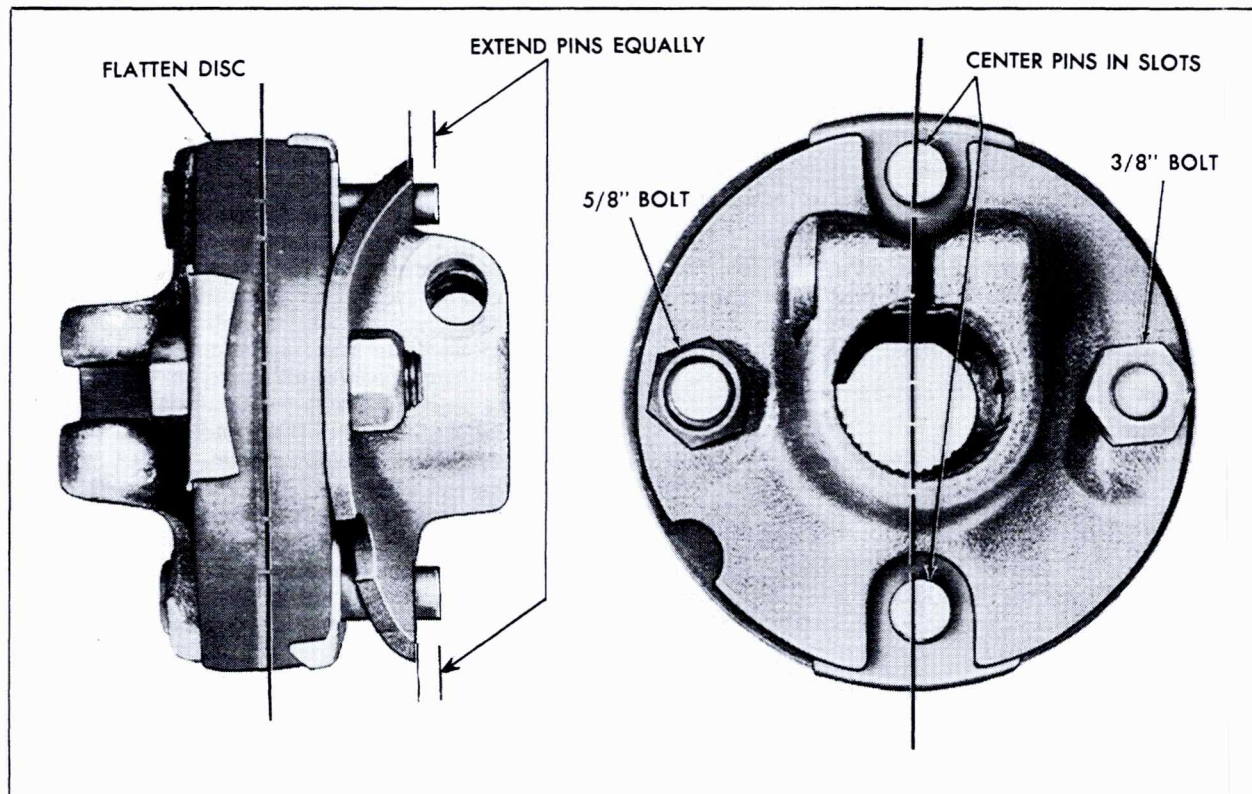


Fig. 9-11 Steering Shaft Flex Coupling

10. If binding, squeaking or high shift effort exists, loosen upper mounting bracket to support nuts and add or remove shims equally, both sides, between upper steering column support and spacer brackets. Remove one shim on each side at a time and recheck installation. When proper alignment is obtained, repeat step 9 of this procedure.

11. First, tighten finger tight the two screws that secure the lower steering column mounting bracket to toe pan; then, tighten the clamp bolt securing bracket to steering column. Next, go back and tighten the two screws attaching bracket to toe pan. If car is an Eldorado, proceed as follows:

a. Tighten finger tight the three screws that attach the bracket to the toe pan.

b. Tighten clamp bolt securing bracket to steering column.

c. Tighten outer screw to toe pan.

d. Tighten inner two screws to toe pan.

12. Torque all clamp screws and bolts to 20 ft. lbs. for both standard car and Eldorado.

13. Install steering column lower cover as described in Section 12, Note 45b, and recheck for proper operation of assembly. If necessary, repeat step 10.

NOTE: Additional adjustment is provided for at the upper steering column support to upper shroud panel at base of windshield only if the above steps do not align column properly.

CAUTION: Check adjustment of neutral switch after realigning column to make sure car cannot be started with the shift lever in any of the drive positions. Follow procedure for neutral switch adjustment as outlined in Section 12, Note 41.

7. Steering Pump

a. Removal

1. Disconnect return hose from fitting on pump. Position hose on top dustshield and cap pump fitting to prevent loss of fluid.

2. Remove nut and hardened flat washer securing pump mounting bracket to cylinder head stud.

3. Remove adjusting screw and hardened flat washer securing mounting bracket to front of cylinder block.

4. Loosen remaining screw.

5. Remove drive belts from pulley.

6. Disconnect high pressure hose from rear of pump. Position hose out of way and cap pump fitting to prevent loss of fluid.

7. Remove screw loosened in Step 4.

8. Remove pump with bracket attached.

9. Remove hardened flat washer from cylinder head stud.

b. Installation

1. Install hardened flat washer on cylinder head stud.

2. Position pump to engine and install bottom pivot screw securing pump to front of cylinder block.

3. Position belts on pulley.

4. Install remaining screw and washer in pump bracket adjuster slot, securing pump bracket to front of cylinder block.

5. Position pump to take up slack in belts, but do not tension belts.

6. Connect high pressure hose at rear of pump. Tighten fitting to 25 foot-pounds.

NOTE: Position hose in a smooth arc to clear oil dipstick.

7. Install nut securing pump to support bracket.

8. Adjust belt tension as follows:

a. Place Belt Tension Gage, J-7316, on drive belt midway between pulleys at location B, shown in Section 6, Fig. 6-5.

b. Loosen steering pump adjusting nut at top of pump mounting bracket, lower adjusting slot bolt and pivot bolt.

c. Move power steering pump as required until correct belt tension is obtained on gage.

NOTE: Proper tension for a new belt is 100 lbs., and 55-70 lbs. for a belt that has been previously tensioned.

d. Snug lower adjusting slot bolt.

e. Snug lower pivot bolt.

f. Snug upper adjusting slot nut.

9. Tighten lower adjusting slot bolt to 20 foot-pounds.

10. Tighten lower pivot bolt to 20 foot-pounds.

11. Tighten upper adjusting slot nut to 20 foot-pounds.

12. Install return hose on fitting at side of pump and secure with clamp. Tighten clamp to 20 inch-pounds.

13. Check fluid level as described in Note 1.

14. Bleed steering gear as described in Note 1, Step 3.

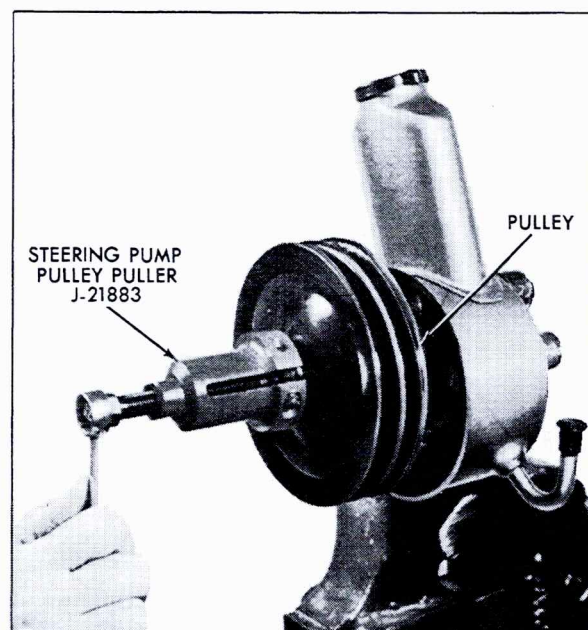


Fig. 9-12 Removing Pump Pulley

8. Steering Pump Disassembly, Cleaning and Inspection, and Assembly

a. Disassembly (Fig. 9-13)

1. Remove pump as described in Note 7a.
2. Clamp mounting bracket in vise with pump attached. Remove pulley from shaft using Pump Pulley Puller, J-21883, Fig. 9-12.

CAUTION: Never remove pulley by pounding it off with a hammer. This could damage pulley as well as snap ring at inner end of the shaft. If the snap ring is damaged, complete disassembly of the pump is required for replacement.

3. Remove woodruff key from shaft.
4. Remove two bolts and lockwashers securing link to bracket and front of pump.
5. Remove bracket by removing two mounting bolts and lockwashers.
6. Place pump assembly in vise, shaft down, using flat on housing for one clamping surface. Do not exert excessive force, as this may distort housing.
7. Remove pressure union and O-ring seal from rear of pump assembly. Discard O-ring seal.

CAUTION: Spring loaded flow control valve tends to "pop" out when pressure union is removed.

8. Lift reservoir from pump housing by rocking reservoir up and away from housing.
9. Remove and discard outer pump housing O-ring seal, mounting bolt O-ring seals, and flow control valve opening O-ring seal.
10. Rotate end plate retaining ring so that one end of ring is over hole in housing. Spring one

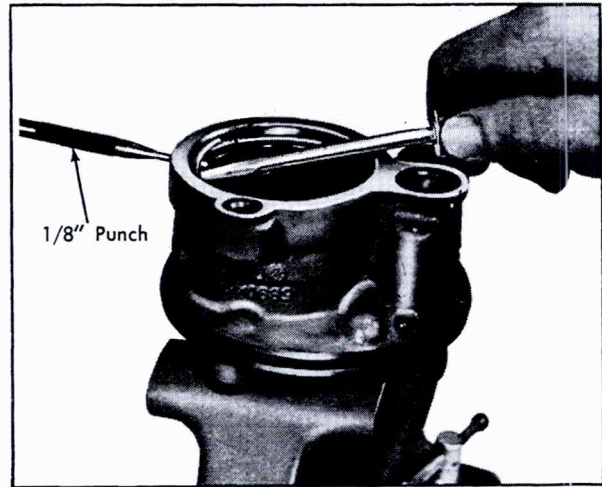


Fig. 9-14 Removing End Plate Retaining Ring

end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-14.

11. Remove end plate. End plate is spring loaded and will generally raise above the housing, making removal easy. However, if end plate should stick, a slight rocking action on top surface will free the plate.

12. Remove pressure plate spring.

13. Remove pressure plate, cam ring, and dowel pins from pump housing.

14. Remove pump from vise, and remove flow control valve and spring. Flow control valve is serviced as a unit and should not be disassembled.

15. Tap end of shaft lightly on bench until shaft is free from pump housing. Then remove shaft with rotor and vanes, and thrust plate attached.

16. Remove vanes from rotor, then remove retaining ring from splined end of shaft and re-

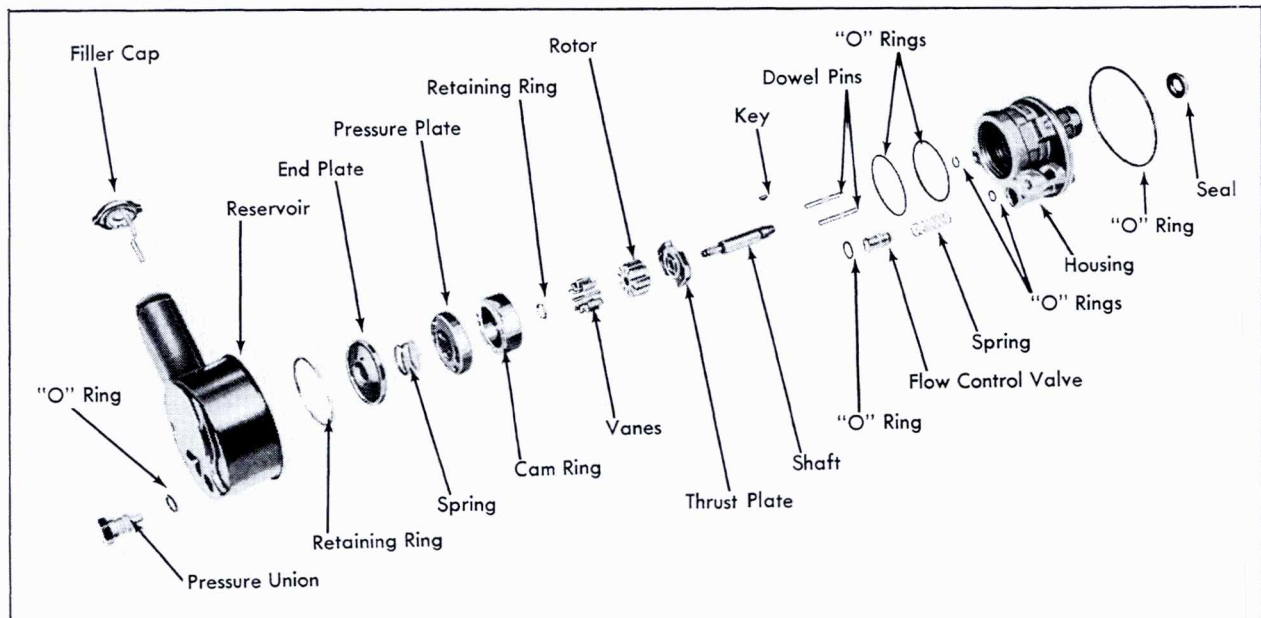


Fig. 9-13 Steering Pump Disassembled

move rotor and thrust plate from shaft. Discard retaining ring.

NOTE: To remove retaining ring, clamp shaft in soft jawed vise, and using a pair of long nose pliers or a screwdriver, pry retaining ring off shaft. Be careful not to damage shaft with vise jaws.

17. Remove pressure plate O-ring seal and end plate O-ring seal from bore of housing and discard.

18. Remove shaft seal from housing only if defective, since it will be destroyed if it is removed. Remove shaft seal if necessary by prying out with screwdriver.

b. Cleaning and Inspection

Carefully clean all pump parts in cleaning solvent. Do not immerse the drive shaft seal in cleaning solvent as this could damage it. Replace any damaged or worn parts.

1. Inspect flow control valve assembly for score marks, wear, burrs, or other damage.

2. Inspect castings for cracks or other visual evidences of damage. Check machined surfaces, especially mating surfaces on O-ring seats, for scratches or burrs that might permit leaks. Examine the V-shaped notches at edges of discharge ports on pressure plate. These notches must be clean and undamaged if pump noise is to be avoided, as they cushion the hydraulic shock when each vane passes the port.

3. Inspect cam ring end surfaces for score marks.

NOTE: Cam ring is treated with "Lubrite" which leaves a dull gray-black finish on wear surface. Wavy grain appearance inside cam ring is normal.

4. Inspect pump shaft for score marks, excessive wear, or damage -- particularly at splines, keyway, and at bearing and seal surfaces. Separate rotor and vanes and inspect for wear and general condition.

5. Inspect shaft bushing in pump housing, and replace pump housing if bushing is scored or excessively worn.

6. If any internal parts are found to be worn or damaged, flush steering gear or disassemble gear and clean internal parts.

c. Assembly

1. Lubricate new O-ring seals and seal areas with power steering fluid.

2. If drive shaft seal was previously removed, lubricate new shaft seal with power steering fluid and install in housing with metal backing up. Use Seal Installer, J-7728, Fig. 9-15.

3. Install new pressure plate and end plate O-ring seals in grooves in pump housing.

4. Install thrust plate on drive shaft with ported face toward splined end of shaft.

5. Install rotor on shaft with counterbored end toward thrust plate.

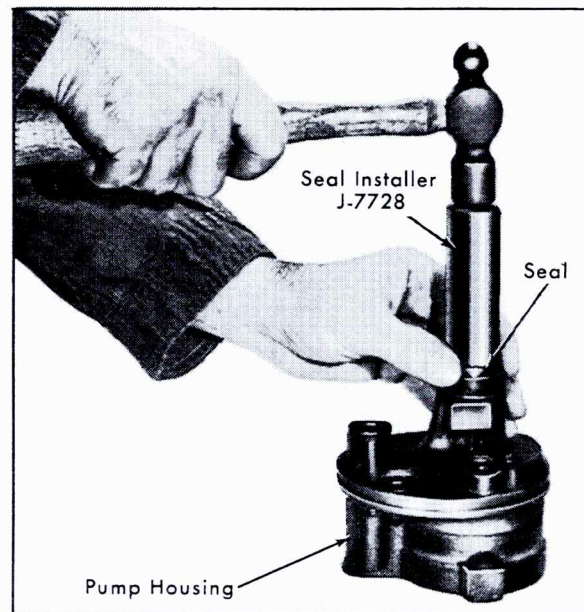


Fig. 9-15 Installing Pump Shaft Seal

6. Clamp shaft in soft jawed vise and install new retaining ring on splined end of shaft by prying ring open and sliding it down over shaft until it seats itself in ring groove. Be careful not to damage shaft.

7. Insert drive shaft with thrust plate and rotor into housing, using Seal Protector, J-22616, Fig. 9-16. Make sure that shaft is properly seated.

8. Place pump housing in vise, hub down, using flat on hub for one clamping surface.

9. Install dowel pins through thrust plate into pump housing.

10. Install cam ring on dowel pins with rotation arrow toward rear of pump housing and pointing in direction of pump rotation, Fig. 9-17. Direction of rotation is counterclockwise when viewed from rear of pump.

11. Install vanes in slots in rotor, with radius edges toward outside of rotor, so they ride on cam ring.

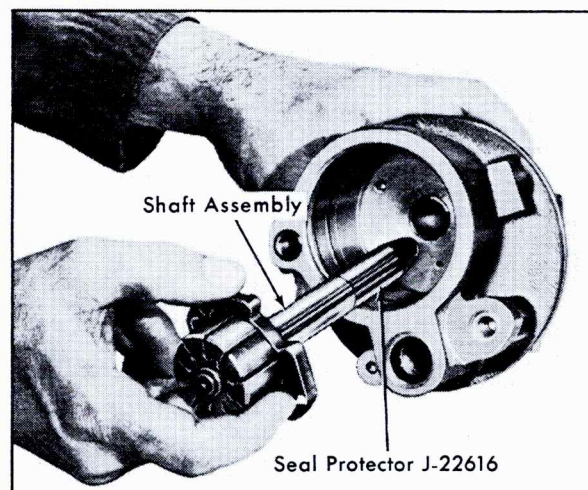


Fig. 9-16 Installing Pump Shaft Assembly

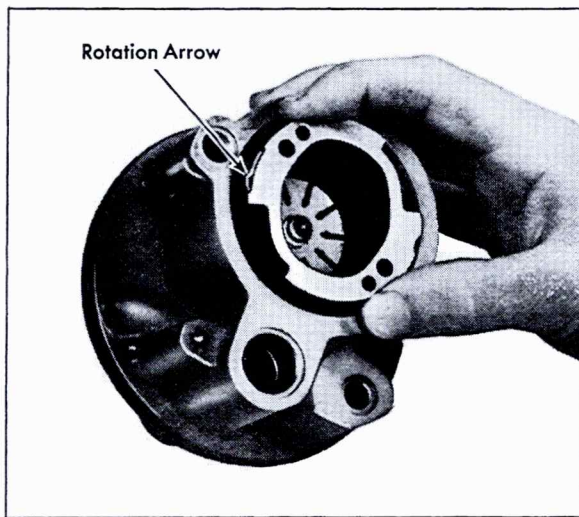


Fig. 9-17 Installing Cam Ring

12. Lubricate outside diameter of pressure plate with petrolatum to prevent damage to O-ring and install pressure plate on dowel pins with ported face toward cam ring. Install plate so that narrow slots in plate engage dowel pins. Make sure that pressure plate is properly seated by tapping lightly around outer circumference with a wooden hammer handle.

13. Install pressure plate spring.

14. Lubricate outside diameter of end plate with petrolatum and install end plate in pump housing.

15. Place pump housing in arbor press, depress end plate below retaining ring groove, and install end plate retaining ring, Fig. 9-18. Make certain that ring is completely seated in groove of housing.

16. Install new outer pump housing O-ring seal, flow control valve opening O-ring seal and mounting bolt O-ring seals in pump housing.

17. Install reservoir on pump housing. Do not hammer on housing.

18. Install flow control valve spring.

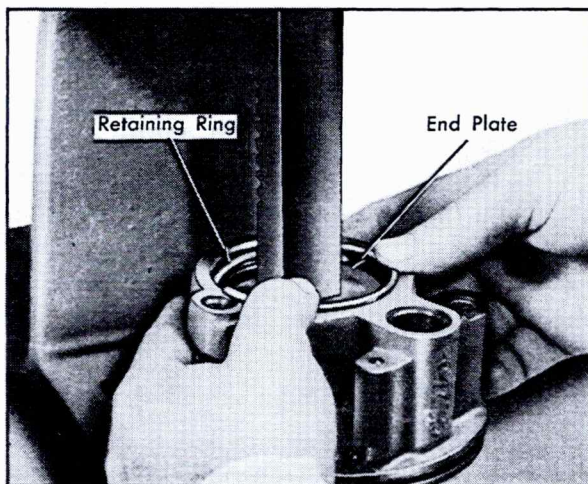


Fig. 9-18 Installing End Plate Retaining Ring

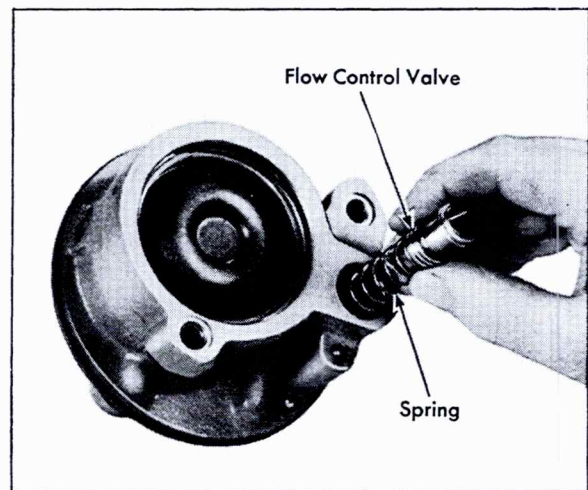


Fig. 9-19 Installing Flow Control Valve

19. Install flow control valve; hex head screw goes into bore first, Fig. 9-19.

20. Install pressure union using a new O-ring seal. Tighten to 30 foot-pounds.

21. Install mounting bracket on pump and secure with two bolts and lockwashers. Tighten bolts to 23 foot-pounds.

22. Clamp mounting bracket in vise with pump attached.

23. Install link between bracket and front of pump using two bolts and lockwashers. Tighten bolts to 23 foot-pounds.

24. Install woodruff key in shaft.

25. Install pulley on shaft by first aligning key in shaft with keyway in pulley. Position pulley by hand as far on shaft as possible.

26. Install pulley nut, tighten to 45 foot-pounds.

27. Install pump on car as described in Note 7b.

9. Steering Pump Shaft Seal Replacement (Off Car)

Steering pump shaft seal cannot be replaced with pump on car as there is insufficient clearance for application of tools for removing pulley and installing seal. For replacing seal only, proceed as follows:

1. Remove pump from car as described in Note 7a.

2. Clamp mounting bracket in vise with pump attached and remove pulley from shaft, using Pulley Remover, J-21883, Fig. 9-12.

CAUTION: Never remove pulley by pounding it off with a hammer as this could damage pulley as well as internal parts.

3. Remove woodruff key from pump drive shaft.

4. Remove shaft seal by prying out with sharp tool.

CAUTION: Insert sharp tool between seal and pump housing. Do not pry against pump shaft.



Fig. 9-20 Installing Pump Shaft Seal

5. Install Seal Protector, J-22616, on pump drive shaft.

6. Position new shaft seal on drive shaft with metal backing facing pulley end of shaft.

7. Install seal, using Pump Shaft Seal Installer, J-7728, Fig. 9-20. Tap tool lightly with small hammer until seal is properly seated in shaft hub.

8. Install pulley as described in Note 8c, steps 24, 25 and 26.

10. Steering Gear Assembly (Except 693)

a. Removal

1. Disconnect pressure and return line hoses at steering gear. Have container ready to catch dripping oil. Secure hose ends in raised position to prevent loss of fluid.

2. Raise car.

3. Remove cotter pin and nut at pitman arm.

4. Disconnect pitman arm from steering linkage drag link using Puller Tool, J-8990-01.

NOTE: Make certain puller tool engages the tabs on the pitman arm.

5. Remove screw that holds flexible coupling to steering column shaft.

6. Remove three screws that hold steering gear to frame side rail, lower gear assembly down and out of car with pitman arm attached.

7. Working on bench, remove nut and lock washer, break pitman arm loose from Pitman shaft using Pitman Arm Puller, J-9172; and remove pitman arm from steering gear.

NOTE: Residual torque on nut after driving may range from 10-200 foot-pounds.

b. Installation

1. Place steering gear in position on frame side rail so that flexible coupling splines match steering column splines. Install three gear housing to frame mounting screws. Tighten screws to 60 foot-pounds.

2. Install screw that holds flexible coupling to steering column shaft. Tighten to 30 foot-pounds.

3. Check gear to steering column alignment and adjust as described in Note 6.

4. Position pitman arm on pitman shaft and drag link and install lockwasher and nut on end of pitman shaft. Tighten nut to 140 foot-pounds to seat pitman arm on shaft.

5. Connect steering linkage drag link to pitman arm. Tighten nut to 40 foot-pounds and install cotter pin.

6. Connect pressure and return line hoses to steering gear. Tighten fittings to 25 foot-pounds.

7. Check fluid level and bleed hydraulic system as described in Note 1.

8. Check steering wheel and center if necessary as described in Note 18c.

11. Steering Gear, Removal of Major Components

1. Position gear assembly horizontally in vise and clamp lower tab at valve end of gear as shown in Fig. 9-37.

2. Rotate gear housing end plug retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-21.

3. Rotate coupling flange counterclockwise until rack-piston loosens end plug in housing. Remove end plug and O-ring from housing.

CAUTION: Do not rotate any further than necessary or balls will fall out of their circuit and pitman shaft teeth and rack-piston will become disengaged.

4. Rotate coupling flange clockwise 1/2 turn and remove rack-piston end plug using a 1/2 inch square drive.

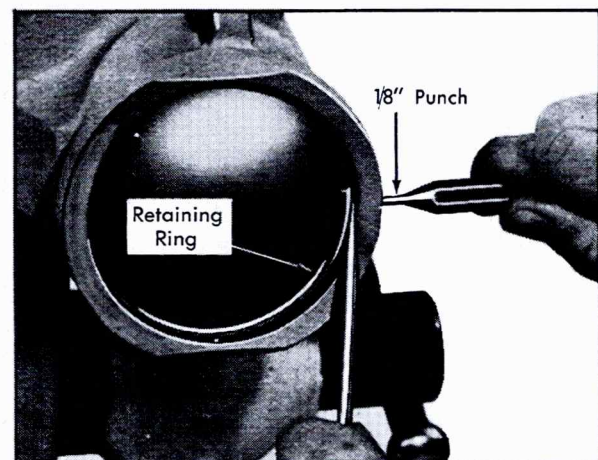


Fig. 9-21 Removing End Plate Retaining Ring

NOTE: To make removal easier, tap rack-piston end plug with a plastic mallet to unseat threads. This is important, as end plug is tightened to 75 foot-pounds during assembly and could break during removal if not handled carefully.

5. Turn coupling flange until pitman shaft teeth are centered in housing.

6. Remove locknut from adjuster screw on end of pitman shaft and discard.

7. Remove four side cover-to-housing retaining screws.

8. Rotate pitman shaft adjuster screw with an Allen wrench until side cover is lifted free from housing.

9. Separate side cover from pitman shaft. Discard side cover O-ring seal.

10. Tap end of pitman shaft with a soft mallet and slide pitman shaft out of housing. Remove slowly as oil will drain from the housing.

11. Remove housing end plug O-ring seal from housing and discard if not previously removed.

12. Insert Rack-Piston Arbor, J-21552, into rack-piston against end of worm. Turn coupling flange counterclockwise, while holding tool tightly against worm, to force rack-piston on to arbor, and remove rack-piston from gear housing, Fig. 9-22. Do not remove Rack-Piston Arbor from rack-piston until ready to remove balls from rack-piston.

NOTE: On 693 steering gears the large snap ring visible at the bottom of the bore is a stop. Do not remove this snap ring.

13. Remove flexible coupling flange retaining screw and remove coupling flange assembly.

14. Remove adjuster plug locknut by breaking it loose with hammer and punch, and remove locknut from housing.

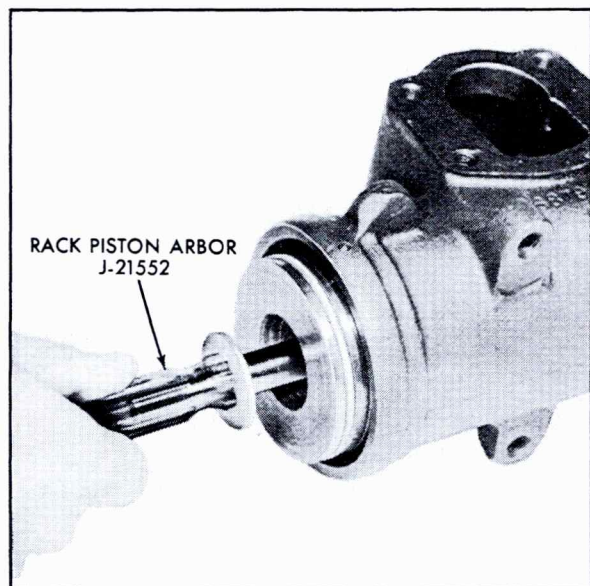


Fig. 9-22 Installing Rack Piston Arbor

15. Loosen adjuster plug assembly, using Spanner Wrench J-7624, Fig. 9-23, and remove from housing.

16. Remove valve assembly by grasping stub shaft and pulling out.

17. Remove worm, lower thrust bearing, and races from upper end of housing.

12. Steering Gear, Disassembly, Inspection and Assembly of Major Components

Disassembly of the major components within the gear must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Refer to Fig. 9-24 for parts nomenclature and location.

a. Gear Housing, Pitman Shaft Needle Bearing, and Seals

Disassembly

1. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and then remove outer back-up washer.

2. Drive needle bearing, outer seal, inner back-up washer, and inner seal from gear housing bore with Pitman Shaft Bearing Remover, J-6657. Discard seals.

Inspection

1. Inspect pitman shaft and needle bearing for broken or pitted rollers.

2. Inspect housing bore. If badly scored or worn, replace housing.

3. Inspect high pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14. Inspect poppet and seat and replace if deformed or scored.

4. Inspect low pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14.

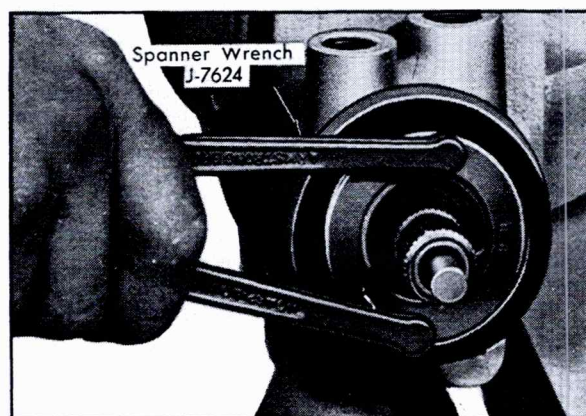


Fig. 9-23 Removing Adjuster Plug

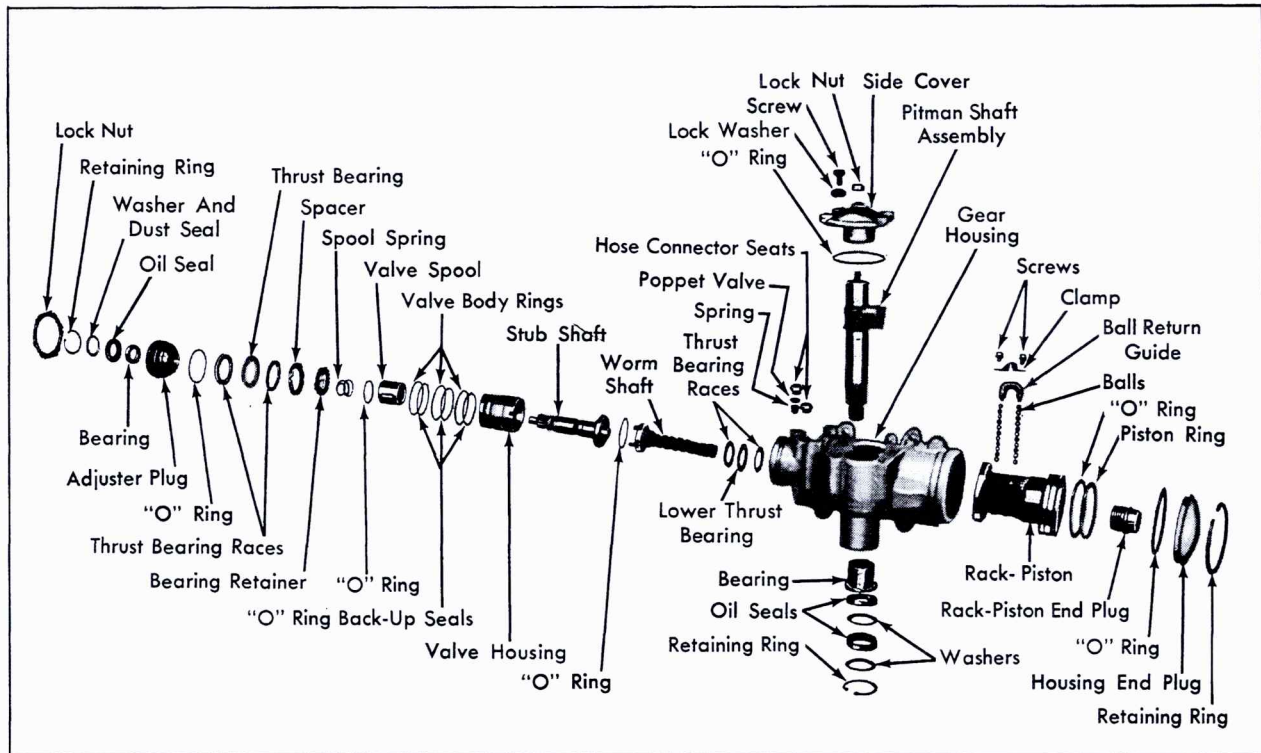


Fig. 9-24 Steering Gear Disassembled

5. Inspect ball plug in valve body end of housing. If it is leaking or raised above the surface, it may be driven flush or 1/16 inch below surface. Ball can be tightened by staking housing.

6. Inspect all retaining ring grooves and seal surfaces for damage or failure.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Install pitman shaft needle bearing on Bearing Installer J-22407, with shoulder on bearing against tool. Position bearing and tool in housing and press bearing into housing, until bearing is bottomed out against hub of housing, Fig. 9-25. On constant ratio steering gears press bearing in until bottom edge of bearing is flush with the housing bore surface.

3. Lubricate pitman shaft bore and single lip pitman shaft seal with power steering fluid and install seal, lip down, into bore, using Seal In-

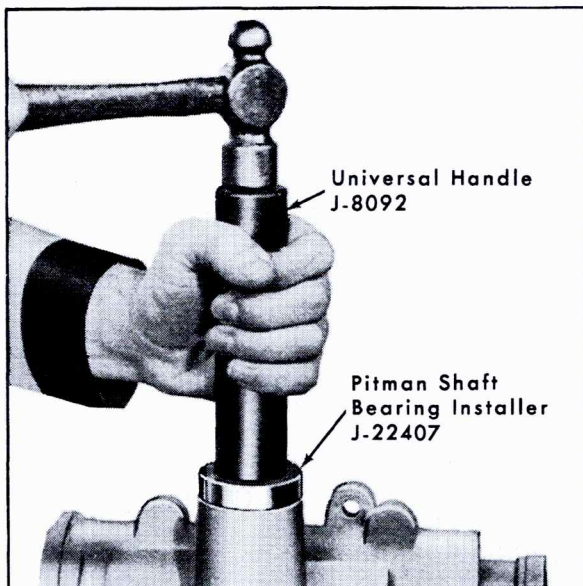


Fig. 9-25 Installing Pitman Shaft Bearing

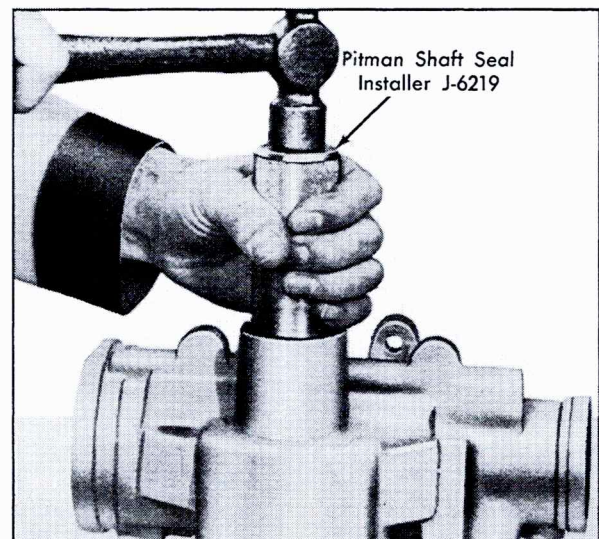


Fig. 9-26 Installing Pitman Shaft Seal

staller, J-6219, Fig. 9-26. Do not drive seal more than 1/8 inch below lip of bore.

4. Remove tool and place steel washer on top of seal. Using tool J-6219, drive seal approximately 1/2 inch further into bore.

5. Lubricate double lip seal with power steering fluid and install seal into housing bore. Using Seal Installer, J-6219, drive seal down into bore until top edge of seal is flush with bottom edge of retaining ring groove.

6. Remove tool and place steel washer and retaining ring over seal. Using tool J-6219, drive both seals down into bore until retaining ring falls into retaining ring groove.

NOTE: In order to avoid possible damage to sealing surface of lower seal, it is important that seals and washers be driven down only far enough so that retaining ring falls into ring groove.

b. Adjuster Plug Assembly

Disassembly

1. Remove thrust bearing retainer with a screwdriver, Fig. 9-27, being careful not to score needle bearing bore, and discard. Remove thrust bearing spacer, thrust bearing, and thrust bearing races.

2. Remove adjuster plug O-ring seal and discard.

3. Remove stub shaft retaining ring, using Snap Ring Pliers, J-4245 (#3).

4. Remove combination washer and dust seal and discard.

5. Remove stub shaft oil seal by prying out with screwdriver and discard.

Inspection

1. Inspect needle bearing in adjuster plug. If rollers are broken or pitted, remove needle bearing by pressing out from thrust bearing end, using Adjuster Plug Bearing Remover and Installer, J-6221, Fig. 9-28.

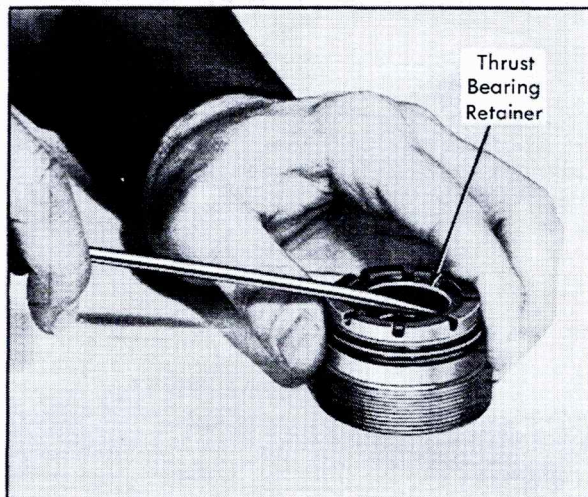


Fig. 9-27 Removing Thrust Bearing Retainer

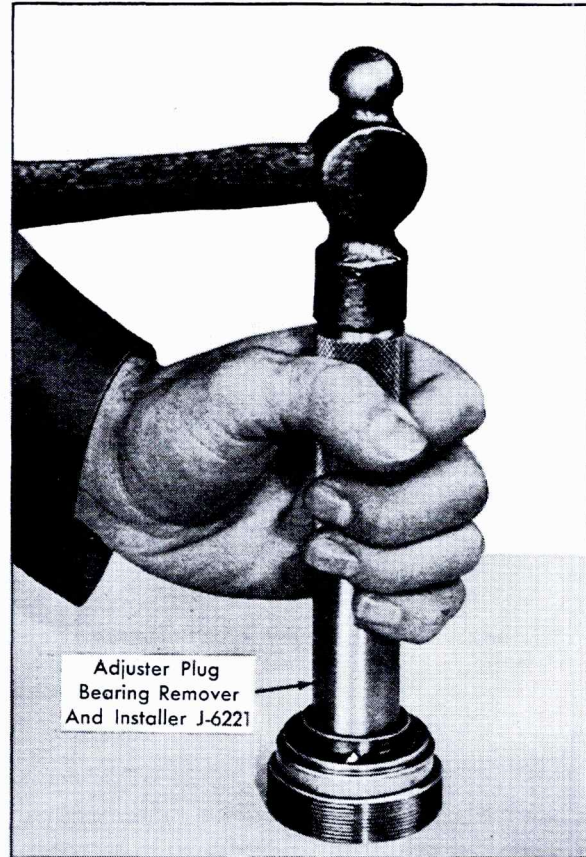


Fig. 9-28 Removing and Installing Adjuster Plug Bearing

2. Inspect thrust bearing spacer for cracks.

3. Inspect thrust bearing rollers for wear, pitting, scoring, or cracking. If any of these conditions are found, replace bearing and both thrust bearing races.

4. Inspect thrust bearing races for wear, pitting, scoring, cracking or brinelling. If any of these conditions are found, replace races and check thrust bearing and thrust bearing spacer.

Assembly

1. If adjuster plug needle bearing was previously removed, install new needle bearing on Tool J-6221, with letters on bearing against tool. Position bearing and tool over thrust bearing end of plug and drive bearing into plug, Fig. 9-28. End of bearing must be flush with bottom surface of stub shaft seal bore.

2. Lubricate new stub shaft oil seal with power steering fluid and, using Adapter Plug Seal Installer, J-5188, Fig. 9-29, install seal far enough to provide clearance for dust seal and retaining ring.

3. Lubricate new dust seal with power steering fluid and install in plug with rubber face outward.

4. Install retaining ring with Snap Ring Pliers, J-4245 (#3), making certain that ring is properly seated.

5. Lubricate new O-ring seal with power steering fluid and install in groove on adjuster plug. Assemble large O.D. thrust bearing race, and

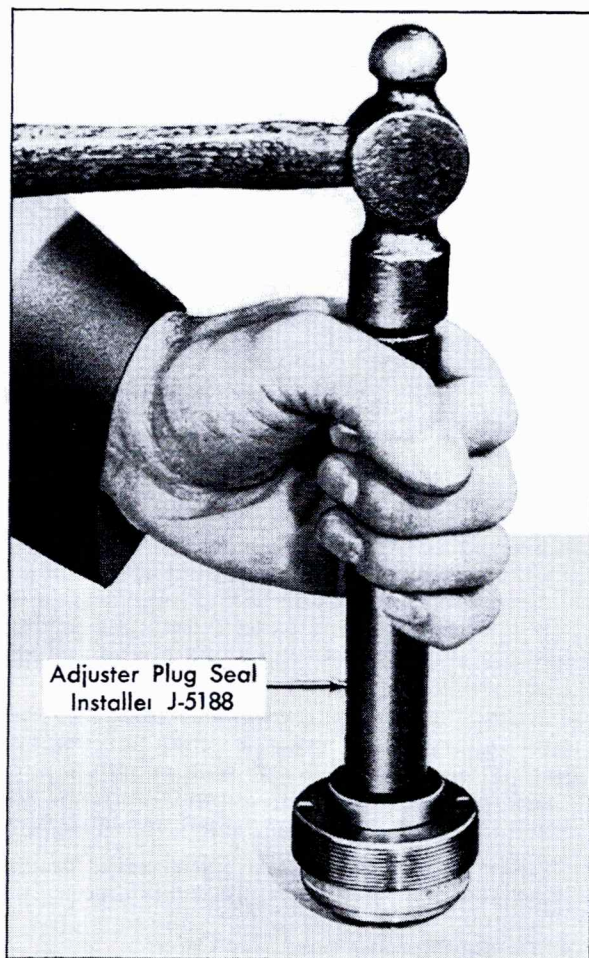


Fig. 9-29 Installing Oil Seal

thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Press bearing retainer into needle bearing bore, using a brass or wooden dowel. Radial location of dimples is not important.

c. Stub Shaft and Valve Assembly

The complete valve assembly is a precision unit with selective fitted parts hydraulically balanced during assembly. If replacement of any valve part other than rings or seals is necessary, the complete rotary valve assembly must be replaced.

Do not disassemble valve unless absolutely necessary, to avoid possibility of damage to the assembly. If valve spool dampener O-ring requires replacement, remove valve spool as outlined below, replace O-ring and install spool.

Disassembly

1. Remove cap to worm O-ring seal and discard.
2. Remove spool spring by prying small coil, using a small screwdriver. Work spring onto bearing diameter of stub shaft. Slide spring off stub shaft.
3. Remove valve spool from valve body.

CAUTION: Clearance between valve body and spool may be as low as .004 inch. Slightest cocking of spool may cause it to stick in the valve body. To remove valve spool:

- a. Hold valve assembly in both hands with stub shaft pointed downward.
- b. Place fingers under valve body and thumbs on valve body cap, holding it securely against valve body.
- c. Tap end of torsion bar lightly against workbench. This will expose spool far enough so that it may be withdrawn from valve body.
- d. Withdraw spool with a steady twisting pull to prevent jamming. If slight sticking occurs, carefully work spool back into valve body. If this does not free spool, it has become cocked in the valve body bore. Do not attempt to force the spool in or out if it becomes cocked. Continue to disassemble valve assembly as follows and return to spool as described later.

4. Remove stub shaft, torsion bar, and valve cap assembly by holding valve assembly in both hands as before, only with thumbs on valve body. Tap torsion bar lightly against workbench. This will dislodge cap from valve body-to-cap pin. Stub shaft, torsion bar, and valve cap assembly can now be removed from valve body.

5. If valve spool has become cocked as described in step 3, it can now be freed. Visual inspection of a flat surface will show in which direction spool is cocked. A few very light taps with a light, soft plastic or rawhide mallet should align spool in bore and free it.

CAUTION: Do not tap with anything metallic. If spool can be rotated, it can be removed.

Inspection

1. If there is evidence that torsion bar O-ring seal inside stub shaft has been leaking, entire valve assembly should be replaced.
 2. Check pin in valve body that engages cap. If it is severely worn, cracked, or broken, the entire valve assembly should be replaced.
 3. Check smaller of the two worm pin grooves in valve body. If it is severely worn, entire valve assembly should be replaced.
 4. Check spool drive pin on stub shaft. If it is severely worn, cracked, or broken, entire valve assembly should be replaced.
 5. Examine spool O.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.
 6. Examine valve body I.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.
 7. Check fit of spool in valve body before installing valve spool dampener O-ring seal.
- When lubricated with power steering fluid, spool should rotate smoothly without binding or catching. If either occurs, entire valve assembly should be replaced.

8. Measure spool spring with a scale. Free length should be $53/64$ inch. Inner diameter of top loop of spring should be $49/64$ inch to $51/64$ inch. Replace spring if measurements are not as specified.

9. Examine needle bearing diameter of stub shaft. If it is badly worn, or scored, entire valve assembly should be replaced.

10. Visually inspect valve body rings. If damaged, carefully cut valve rings and O-ring back-up seals. Remove and discard.

Assembly

1. If new valve body back-up O-ring seals are necessary, lubricate them with power steering fluid. Assemble in ring grooves on valve body. Do not allow seals to become twisted. If new valve rings are necessary, lubricate them with power steering fluid and assemble valve rings in ring grooves over back-up O-ring seals by carefully slipping rings over valve body, Fig. 9-30. Rings may appear to be loose in grooves, but the heat of the oil after assembly will cause them to tighten.

2. Lubricate new valve spool dampener O-ring seal with power steering fluid and install seal in valve spool groove.

3. Assemble stub shaft in valve body, aligning groove in valve cap with pin in valve body. Fig. 9-31. Tap lightly on cap with a plastic or rawhide mallet until cap is against shoulder in valve body with valve body pin in cap groove. Hold these parts together during the rest of the assembly.

4. Lubricate valve spool with power steering fluid and slide over stub shaft with notch toward valve body. Align notch with spool drive pin in cap groove stub and carefully engage spool in valve body bore.

CAUTION: Because clearance between spool and valve body is very close, extreme care must be taken when assembling these parts. Push spool evenly and slowly with a slight twisting motion until it reaches drive pin. Rotate spool slowly with pressure until notch

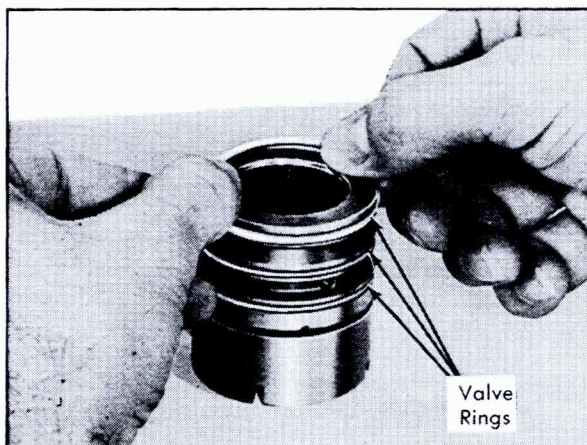


Fig. 9-30 Installing Valve Rings

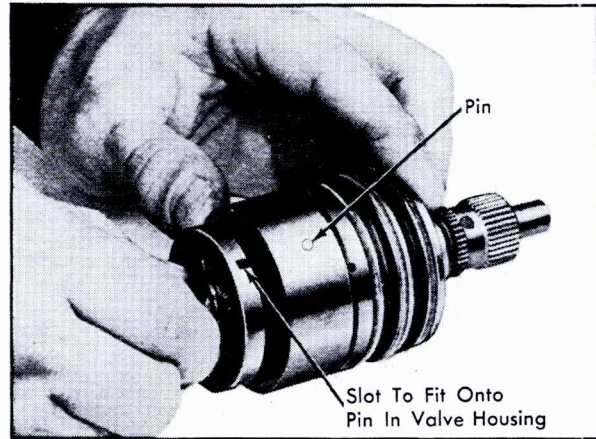


Fig. 9-31 Installing Stub Shaft

engages pin. Before pushing spool completely in, make sure dampener O-ring seal is evenly distributed in spool groove. Slowly push spool in completely, being careful not to cut or pinch O-ring seal by inserting spool beyond its normal position.

5. Slide spool spring over stub shaft and work spool spring down, using a small screwdriver, until spring is seated in stub shaft groove.

6. Lubricate new cap-to-worm O-ring seal with power steering fluid and install in valve body.

NOTE: Do not install upper thrust bearing assembly on valve assembly at this time.

d. Pitman Gear Shaft and Side Cover

Inspection

1. Inspect pitman shaft bearing surface in side cover for excessive wear or scoring. If badly worn or scored, replace side cover.

NOTE: The bearing may extend from the side cover. It is not necessary to reposition the bearing or replace the side cover if this condition occurs.

2. Visually inspect pitman shaft sector teeth, bearing and seal surface. If abnormally worn, pitted, or scored, replace pitman shaft.

e. Rack-Piston and Worm Assembly

Disassembly

1. Place assembly on a clean cloth. Remove return guide clamp screws and remove clamp.

2. Remove ball return guides and Arbor, J-21552. Make sure all 24 balls are caught on the cloth, 22 balls on constant ratio steering gears.

NOTE: Rack-piston ring seldom needs to be replaced.

Inspection

1. Inspect worm and rack-piston grooves and all of the balls for excessive wear or scoring. If

either worm or rack-piston needs replacing, both must be replaced as a matched assembly.

NOTE: Service replacement balls are available in different sizes as described in this Note under "Assembly".

2. Inspect ball return guides, making sure that the ends where balls enter and leave the guides are not damaged.

3. Inspect lower thrust bearing and races for wear, pitting, scoring, or cracking. If any of these conditions are found, replace thrust bearing and races, and check worm.

4. Inspect rack-piston and end plug to be sure threads are not damaged.

5. Inspect rack-piston teeth for abnormal wear or scoring. Inspect rack-piston O.D. for abnormal wear, scoring, or burrs.

6. Visually inspect piston ring; if damaged, remove ring and back-up O-ring seal and discard.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Lubricate new back-up O-ring seal, if necessary, with power steering fluid and install in piston ring groove on rack-piston. Do not allow seal to become twisted.

3. Install new piston ring, if necessary, in groove over O-ring seal.

4. Insert worm into end of rack-piston, from end opposite piston ring, until worm is against rack-piston shoulder.

5. Load 17 balls into guide hole nearest piston ring while slowly rotating worm counterclockwise to feed balls through circuit. Alternate black balls with white balls throughout the circuit.

6. Apply a liberal amount of petrolatum to one ball return guide and install the remaining balls into guide, 7 balls on variable ratio and 5 balls on constant ratio gears. Place the other guide over the balls and ball guide, and insert guides into guide holes of rack-piston. Make sure black ball in guide is installed next to white ball in rack-piston or vice versa. Guides should fit loosely. It is essential that all balls be positioned so that they are alternate in color. No two balls of the same color are to be side by side.

7. Place return guide clamp over guides and secure with two screws and lockwashers. Tighten screws to 12 foot-pounds.

8. Worm groove is ground with a high point in the center. When rack-piston passes over this high point, a preload of 1 to 4 inch-pounds should be obtained. To measure preload of worm and rack-piston ball assembly, proceed as follows:

a. Clamp rack-piston in a bench vise with soft jaws, with worm shaft pointing up. Do not distort rack-piston by over tightening vise.

b. Place valve assembly on worm, engaging worm drive pin.

c. Rotate worm until it extends 1-1/4 inches from rack-piston to thrust bearing face. This is center position.

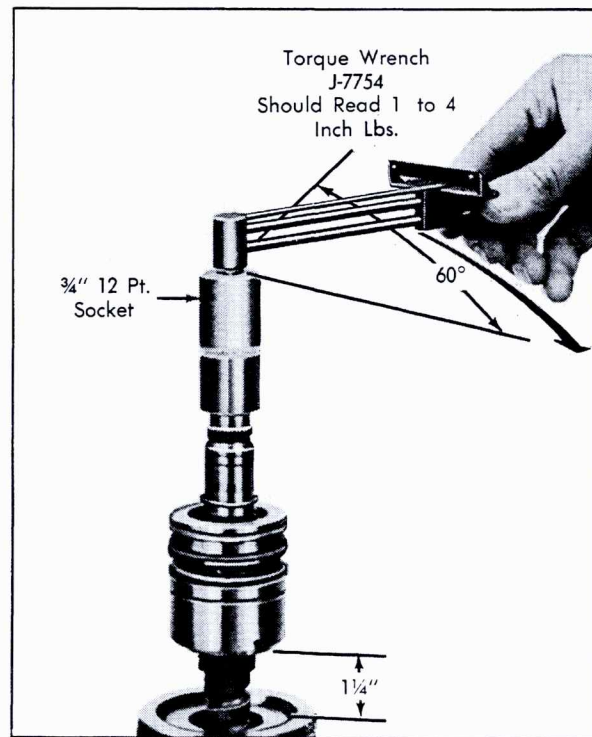


Fig. 9-32 Checking Worm and Rack Piston Preload

d. Place Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft, Fig. 9-32, and rotate wrench through an arc of approximately 60° in both directions several times, then take a torque reading. Highest average reading obtained with worm rotating should be between 1 and 4 inch-pounds.

e. If reading is below 1 inch-pound, a new set of balls must be installed upon reassembly.

Service replacement balls are available in sizes listed in the following chart:

Size Code	Mean Dia.	Size Range of Ball
7	.28125	.28120 - .28130
8	.28133	.28128 - .28138
9	.28141	.28136 - .28146
10	.28149	.28144 - .28154

Note the ball size stamped on the rack-piston and install the next size larger balls to increase the preload.

NOTE: If no number is found on the rack-piston, the original ball size was #7.

A change of one ball size (higher size code) will increase preload approximately 1 inch-pound. Final preload on replacement balls should be 2 to 3 inch-pounds.

9. Remove valve assembly from worm.

10. Remove rack-piston from vise.

11. Insert Worm Gear Ball Arbor, J-21552,

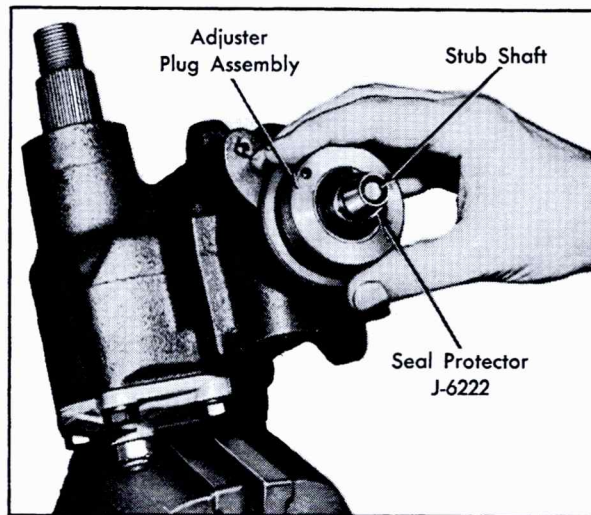


Fig. 9-33 Installing Adjuster Plug

into worm and turn rack-piston onto arbor. Do not allow arbor to separate from worm until rack-piston is fully on arbor.

13. Steering Gear, Installation of Major Components

1. Position gear housing horizontally in vise and clamp lower tab at valve end of gear as shown in Fig. 9-37.

2. Lubricate worm shaft, lower thrust bearing, and races with power steering fluid, then position thrust bearing and races on worm.

3. Align valve body drive pin on worm with narrow pin slot on valve body. Be sure O-ring seal between valve body and worm head is installed.

4. Position valve assembly and worm shaft in housing as an integral unit.

CAUTION: Do not push against stub shaft, as this might cause stub shaft and cap to pull out of valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly can be installed by pushing on the outer diameter of the valve body housing with the fingers of both hands. Make certain that white plastic rings are not binding on inside of housing. Valve assembly is properly seated when oil return hole in gear housing is fully visible.

5. Place Adjuster Plug Seal Protector, J-6222, over end of stub shaft.

6. Lubricate new adjuster plug O-ring seal with power steering fluid and install in groove on adjuster plug.

7. Install adjuster plug assembly over end of stub shaft, Fig. 9-33, and tighten just enough to make certain that all parts are properly seated in gear housing. Remove Seal Protector, J-6222.

NOTE: If Seal Protector, J-6222 is removed too soon, stub shaft seal will be damaged by the shaft splines.

8. Install adjuster plug locknut loosely on adjuster plug.

NOTE: Do not adjust thrust bearing preload at this time.

9. Install Rack-Piston Seal Compressor, J-7576, in gear housing, Fig. 9-34, holding it tightly against shoulder in housing.

10. Insert rack-piston into housing until arbor engages worm. Turn stub shaft clockwise, using a 3/4 inch twelve-point socket or box end wrench, to draw rack-piston into housing. When piston-ring is in housing piston bore, Arbor J-21552, and Seal Compressor, J-7576, can be removed.

11. Turn stub shaft as necessary until middle rack groove in rack-piston is aligned with center of pitman shaft needle bearing.

12. Lubricate new side cover O-ring seal and install in groove in face of side cover.

13. Assemble side cover on pitman shaft by screwing cover on to pitman shaft adjuster screw until side cover bottoms on pitman shaft, and back off 1/2 turn.

14. Install pitman shaft so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before pushing side cover down on gear housing.

15. Install side cover screws and tighten to 35 foot-pounds.

16. Hold adjuster screw with Allen wrench and install new adjuster lock nut half way on adjuster screw.

17. Install rack-piston end plug in rack-piston. Tighten end plug to 75 foot-pounds.

18. Lubricate new housing end plug O-ring seal with power steering fluid and install in gear housing.

19. Insert end plug into gear housing and seat against O-ring seal. Slight tapping with a mallet may be necessary to seat end plug properly.

20. Snap end plug retainer ring into place with fingers. Slight tapping may be required to bottom retainer ring in the gear housing securely.

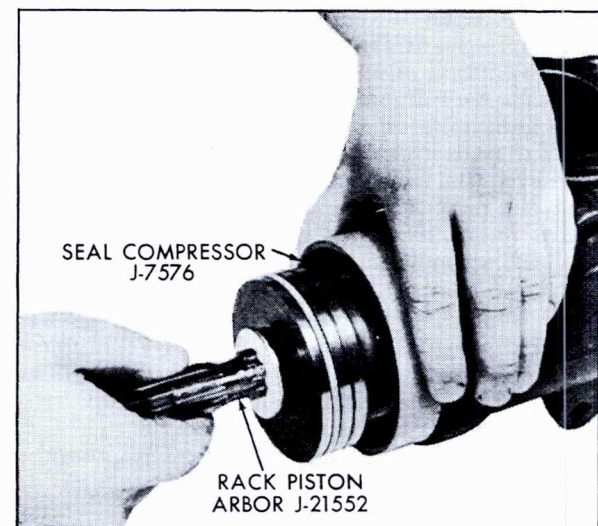


Fig. 9-34 Installing Rack Piston Compressor

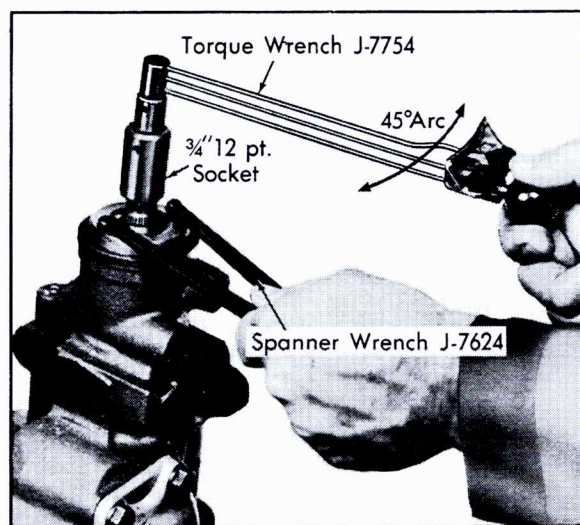


Fig. 9-35 Adjusting Thrust Bearing Preload

21. Position gear assembly with stub shaft end up and adjust thrust bearing preload as follows:

a. Using Spanner Wrench, J-7624, lightly tighten adjuster plug and then back off 1/8 turn.

b. Install 0-25 inch-pound Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft splines, Fig. 9-35.

c. Rotate stub shaft to either the left or right turn stop and then back off from stop 1/2 turn.

d. Rotate torque wrench in a 45° arc and note highest reading.

e. Tighten adjuster plug with Spanner Wrench, J-7624, until there is a preload of 1-3 inch-pounds higher than initial load reading just measured.

f. Tighten adjuster plug locknut securely with punch and hammer.

g. Recheck preload to be sure it still reads 1-3 inch-pounds higher than initial load. If adjustment has changed, readjust.

22. Adjust pitman shaft end play as follows:

a. Rotate stub shaft from one stop to the other and locate center of travel.

b. With gear on center, check combined ball and thrust bearing preload with Torque Wrench, J-7754, with a 3/4 inch 12-point socket, and note highest reading, Fig. 9-36.

c. With pitman gear on center and adjuster screw locknut backed off, adjust pitman shaft so that preload is 8-10 inch-pounds in excess of total preload and drag.

NOTE: These readings should be made by rotating torque wrench in an arc from 60° before center to 60° after center. Total preload of gear should not exceed 20 inch-pounds.

d. With gear on center and reading obtained, tighten adjuster screw locknut to 30 foot-pounds.

23. Install flexible coupling flange assembly on stub shaft with .040 inch clearance between the adjuster plug and the coupling. Install flange screw in coupling. Tighten screw to 30 foot-pounds.

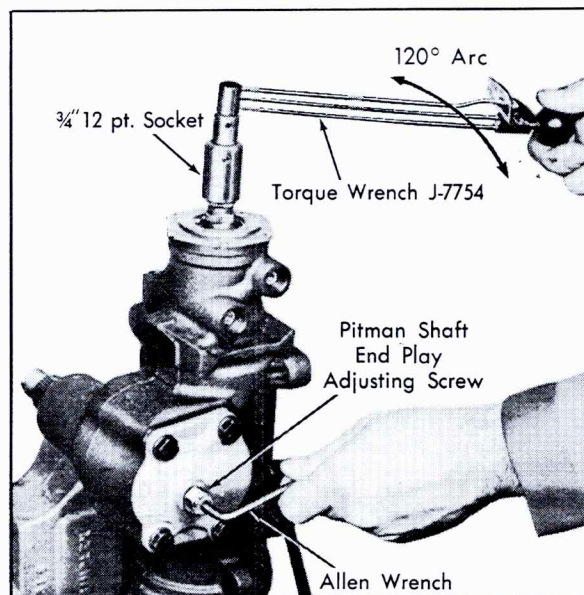


Fig. 9-36 Adjusting Pitman Shaft End Play

14. Steering Gear Hose Connector Seats and Poppet Check Valve Replacement

The following procedure can be performed on car as well as on bench.

1. Disconnect pressure and return line hoses at steering gear and secure hose ends in a raised position to prevent loss of fluid.

2. To prevent metal chips from becoming lodged in valve assembly, pack inside of connector seats of pressure and return port housings with petrolatum.

3. Tap threads in connector seats, using a 5/16-18" tap.

CAUTION: Do not tap threads too deep in pressure hose connector seat as tap will bottom poppet valve against housing and damage it. It is necessary to tap only 2 or 3 threads deep.

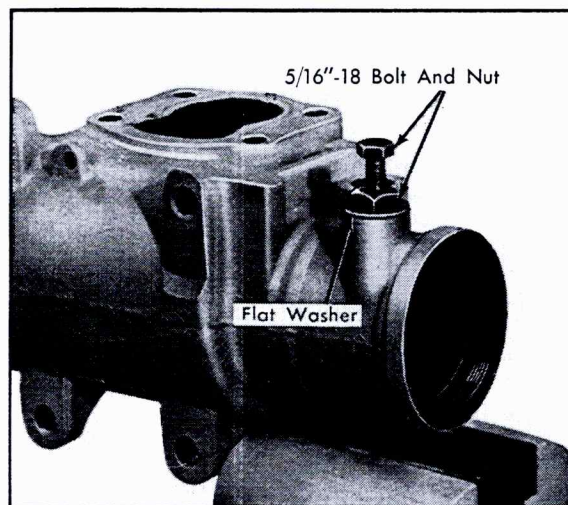


Fig. 9-37 Removing Hose Connector Seat

4. Thread a 5/16"-18 bolt with a nut and flat washer into tapped hole, Fig. 9-37.

5. To pull connector seat, hold bolt from rotating while turning nut off bolt. This will pull connector from housing. Discard connector seat.

NOTE: It is also possible to remove connector by using a No. 4 screw extractor.

6. Wipe petrolatum from housing and clean housing thoroughly to remove any metal chips or dirt.

7. Remove poppet check valve and spring from pressure port and discard.

8. Install new check valve spring in pressure port with large end down. Make sure spring is seated in counterbore in pressure port.

9. Install new check valve over spring with tangs pointing down. Make sure valve is centered on small end of spring.

10. Install new connector seats, using petrolatum to hold connector seat on check valve in pressure port. Drive connector seats in place using Valve Connector Seat Installer, J-6217, Fig. 9-38.

11. Check operation of valve by pushing lightly against valve with a small punch or small rod. Valve should reseal itself against connector seat when pressure is removed from spring.

12. Connect pressure and return line hoses on steering gear. Tighten hose fittings to 25 foot-pounds.

13. Check fluid in pump reservoir and add if necessary.

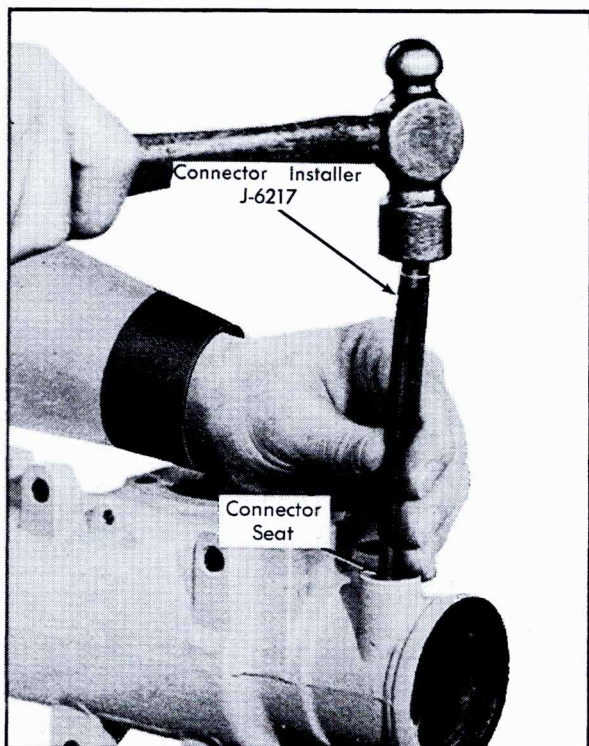


Fig. 9-38 Installing Hose Connector Seat

15. Pitman Shaft Seal Replacement

When inspection indicates that a pitman shaft seal is leaking, it is necessary to remove steering gear from car in order to replace seal. Proceed as follows:

a. Removal

1. Remove steering gear as described in Note 10a.

2. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and then remove outer back-up washer.

3. Insert a screwdriver between outer seal and inner back-up washer, pry out seal, and remove back-up washer.

4. Insert screwdriver between inner seal and shoulder in gear housing and pry out seal. Be careful not to damage seal bore.

5. Inspect seals for damage. If O.D. appears scored, inspect housing for burrs and remove.

NOTE: Always discard used seals and install new seals.

b. Installation

1. Clean end of pitman shaft bore to prevent entrance of dirt into housing or damage to seals as they are installed.

2. Wrap tape around splines of pitman shaft to prevent damage to seals as they are installed. Use only one layer of tape to assure adequate clearance for seals.

3. Install seals as explained in Note 12a, steps 3, 4, 5, and 6, under "Assembly".

4. Replace pitman arm on pitman shaft and install lockwasher and pitman arm retaining nut. Tighten nut to 140 foot-pounds.

5. Install steering gear as described in Note 10b.

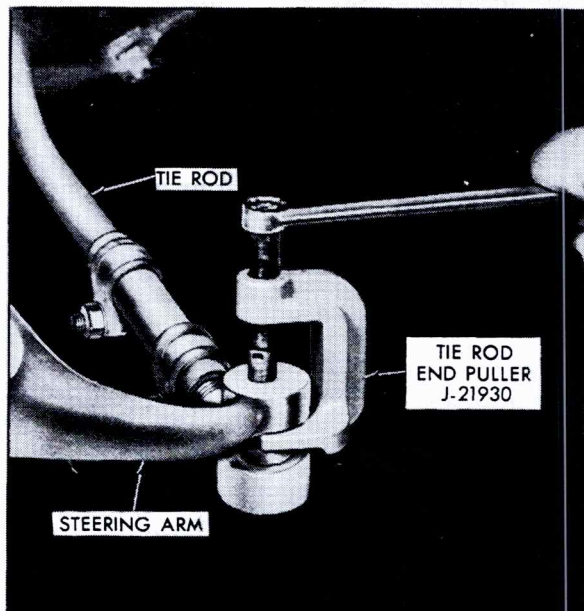


Fig. 9-39 Removing Tie Rod from Steering Arm

6. Connect pitman arm to drag link and install nut and cotter pin. Tighten nut to 40 foot-pounds.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

7. Check fluid level and bleed hydraulic system as described in Note 1.

16. Steering Linkage Removal, Disassembly, Assembly, and Installation (Except 693)

a. Removal

1. Remove cotter pins and nuts from outer tie rod pivots at steering arms.
2. Remove outer tie rod pivots from steering arms, using Tie Rod End Puller, J-21930, Fig. 9-39. Be careful not to damage joint seals.
3. Remove idler arm support mounting screws and lock washers from frame side member.
4. Remove pitman arm cotter pin, nut and washer at steering linkage.
5. Remove steering linkage from pitman arm, using Puller, J-8990-01, Fig. 9-8.
6. Remove drag link with tie rods and idler arm attached.

b. Disassembly

1. Remove cotter pins and nuts from idler arm pivot and both inner tie rod pivots.
2. Remove tie rods, using Tie Rod End Puller, J-21930, Fig. 9-40.
3. Remove idler arm from drag link, using Puller, J-8990-01.
4. Remove dust seals from pitman arm and idler arm pivot studs.
5. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing outer tie rod pivots from adjuster tubes. Be careful not to pull pivot seal off pivot housing.
6. If necessary, remove clamps and adjuster tubes from ends of tie rods.

c. Assembly

1. If previously removed, lubricate adjuster tubes with chassis lubricant. Install adjuster tubes and clamps on ends of rods.

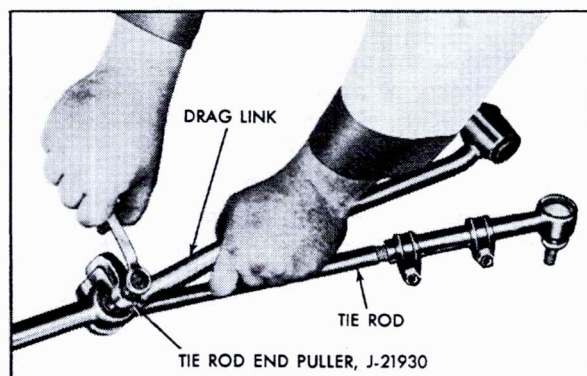


Fig. 9-40 Removing Tie Rod from Drag Link

2. Thread outer tie rod pivots into adjuster tubes, but do not tighten outer clamps.

NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.

3. Install both tie rods on drag link tightening nuts to 50 foot-pounds, and install cotter pin.

4. Install new dust seal on idler arm pivot stud and install idler arm on drag link. Tighten nuts to 40 foot-pounds, and install cotter pin.

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.

5. Install new dust seal on pitman arm pivot stud.

d. Installation

1. Install idler arm support on frame side bar with two mounting screws and lock washers. Tighten mounting screws finger tight.

NOTE: To assure proper rotational capability of the idler arm pivot, screw the idler arm support shaft completely into the idler arm bushing. Then, unscrew the support shaft between 90° and 270° rotationally attaining alignment of the mounting holes with the frame.

2. Install pitman arm at drag link stud. Tighten nut to 40 foot-pounds and install cotter pin.

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.

3. Connect outer tie rod pivots to steering arms, tighten nuts to 35 foot-pounds and install cotter pins.

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.

4. Turn steering wheel back and forth through the straight ahead position (without touching wheel stops) to align linkage. Then tighten idler arm bracket to frame attaching screws to 35 foot-pounds.

5. Adjust toe-in as described in Section 3, Note 1e.

17. Tie Rod End Seal Replacement

1. Raise car.
2. If replacing outer tie rod end seal on 693 style, remove front wheel.
3. Remove cotter pin and nut from outer tie rod pivot.
4. Remove outer tie rod pivot from steering arm using Tie Rod End Puller, J-21930. Remove inner tie rod pivot from drag link using Tie Rod End Puller, J-21930, (J-22292 on 693 style).
5. Pry old seal off pivot housing.
6. Wipe pivot and housing clean.
7. Position new seal on pivot stud. Using Seal

Installer, J-21150-1, move flange of seal over seat on housing with a firm, even push.

NOTE: Make certain that seal installer is positioned squarely on seal.

8. Position tie rod to steering arm or drag link and install nut. Tighten nut on outer tie rod pivot to 35 foot-pounds. Tighten inner tie rod pivot nut to 50 foot-pounds.

9. Secure pivot nut with cotter pin.

NOTE: If holes do not line up, continue to tighten nut until cotter pin can be inserted.

10. Remove service plug from pivot.

11. Using Spherical Joint Repacking Gun, J-9280, repack tie rod end until grease is expelled at lip of seal.

CAUTION: Be sure special spherical joint lubricant is used for this purpose. Ordinary chassis lube is not sufficient for this application.

12. Install service plug in pivot.

13. If outer pivot seals were replaced on 693 style, install front wheel.

14. Lower car.

18. Steering Wheel

a. Removal

CAUTION: Under no circumstances should the steering shaft be struck on the end in an effort to remove the steering wheel. This action will damage delicate parts of the steering column.

1. Remove three screws from back of spokes and lift pad assembly from wheel.

2. On Tilt and Telescope wheel proceed with steps 3 thru 5. On standard wheels proceed to step 6.

3. Remove three screws securing the telescope locking lever assembly to flange and screw assembly.

4. Unscrew flange and screw assembly from steering shaft and remove.

5. Remove locking lever assembly.

6. Remove horn contact wire from plastic tower at wheel hub by gently pulling wire out of tower.

7. Scribe an alignment mark on steering wheel hub in line with slash mark on steering shaft to be used at time of installation.

8. Loosen nut on steering shaft positioning it flush with end of shaft.

9. Carefully install Steering Wheel Puller, J-1859-03 with two 5/16"-18 x 4" bolts. Snug center bolt of puller against steering shaft nut.

CAUTION: Do not tighten center bolt of puller with a wrench as this action can cause damage to threads on steering shaft.

10. Tighten center bolt until steering wheel is loose on shaft, Fig. 9-41.

11. Remove puller.

12. Remove steering shaft nut.

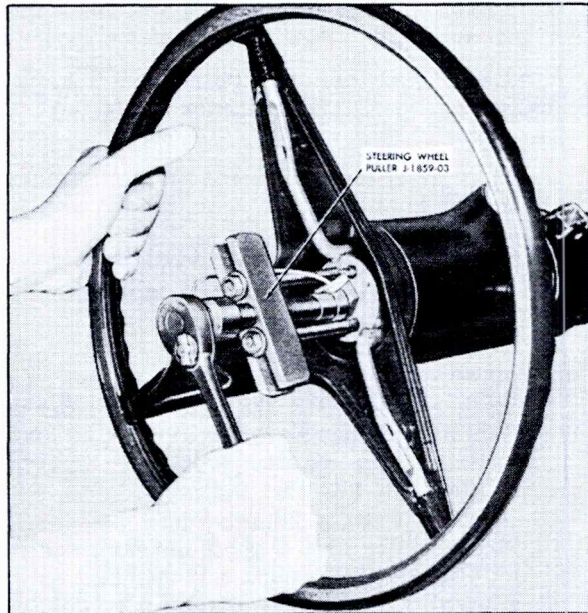


Fig. 9-41 Steering Wheel Removal

13. Lift wheel off steering shaft.

CAUTION: When laying wheel face down, place a cloth on work bench to prevent laminated chrome, wood grain or stripes from being scratched or marked.

b. Installation

1. Install steering wheel, aligning scribe mark on hub with slash mark on end of shaft.

CAUTION: The steering wheel should not be driven on the steering shaft. This action may cause damage to the steering column components.

2. On Tilt and Telescoping columns, proceed to steps 3 through 7. On standard columns, proceed to step 8.

3. Install steering shaft nut and tighten it to 20 foot-pounds.

4. Install locking lever assembly on steering wheel.

5. Screw flange and screw assembly finger tight into steering shaft.

6. Position locking lever assembly against flange and screw assembly with lever in vertical position. Secure with three screws. Check operation of lever after tightening screws to assure proper release and tightening of telescoping shaft.

7. Check operation of telescoping mechanism by rotating locking lever against stops. Check to see that wheel is free to telescope in left position and is securely locked in right position.

NOTE: When lever is securely locked, it should not contact steering wheel spoke. If necessary, readjust as described in steps 5 and 6.

8. Install steering shaft nut and tighten to 20 foot-pounds.

9. Install horn contact wires.

10. Position pad assembly on wheel and secure with three screws from rear side of wheel.

c. Alignment

In the event the steering wheel is "off-center" when the car is being driven down the road, it will be necessary to align steering wheel or front wheels as described below:

1. Check steering wheel for proper position on steering shaft. With steering wheel "centered" in car, slot in flexible coupling upper shaft flange should be facing upward with scribe mark on upper end of steering shaft at "12 o'clock". If necessary, reposition steering wheel on shaft.

2. Drive car on a straight flat road to determine whether or not steering wheel is still "off-center".

3. If steering wheel is still "off-center", mark top of the wheel with a small piece of tape or crayon for reference when making correction.

4. Set wheel straight ahead and adjust tie rods. Shorten left tie rod and lengthen right tie rod if top of wheel is to the left of center, or shorten right tie rod and lengthen left tie rod if top of wheel is to the right of center. Be careful not to damage joint seals when adjusting tie rods.

NOTE: Tie rod adjustment must be made on a wheel alignment machine so that correct toe-in setting is maintained.

19. Steering Column Removal and Installation

a. Removal

1. Raise hood and disconnect negative battery cable.

2. Remove clamp screw and lockwasher that secure flexible coupling upper flange to steering shaft on all cars except 693. On 693 series, remove lower steering shaft as described in Note 26a.

3. Remove bolt and lockwasher that secure lower shift lever to column.

4. On all cars except 693 series, remove two screws and flat washers that secure lower steering clamp to cowl. On 693 series, remove three screws and flat washers.

5. Remove nut and lock washer that secure lower mounting bracket to steering column jacket.

CAUTION: The lower clamp must be removed before loosening the column to upper bracket attachment, as column may bend under its own weight.

6. Remove steering column lower cover as described in Section 12, Note 45a.

7. Remove screw securing transmission shift indicator pointer to shift bowl shroud and remove pointer.

8. Disconnect electrical connectors and vacuum

hoses from neutral and back-up light switch assembly.

9. Pull up on rubber cover and remove two carpet to floor attaching screws to gain access to toe pan seal and retainer.

10. Remove five screws that secure retainer to toe pan.

11. Remove two nuts and hardened flat washers that secure upper column bracket to steering column support and lower column assembly. Take note of the number of shims installed.

CAUTION: Do not let column support its own weight as damage to the collapse joint in the outer jacket may result.

12. Disconnect ignition switch and turn signal switch multiple connectors. On Eldorados equipped with Cruise Control, disconnect Cruise Control harness at connector mounted on the service brake pedal bracket.

13. Carefully pull steering column up and out of car, being careful not to damage ignition and neutral and back-up light switches.

b. Installation

1. With toe pan seal and retainer in position on column, carefully install steering column into position through floor guiding lower steering shaft into flexible coupling flange so that flat on shaft aligns with flat in coupling flange.

CAUTION: Do not let column support its own weight.

2. Connect neutral and back-up light switch, connector, vacuum hoses, turn signal connector and ignition switch connectors.

NOTE: If car is an Eldorado equipped with Cruise Control, connect Cruise Control harness to connector mounted on service brake pedal bracket.

3. Position column and install finger tight the two nuts and hardened flatwashers that secure column upper bracket to column support. Re-install the same number of shims that were found during removal of column.

CAUTION: Make sure that the L-shaped hardened spacer is between the shims and the release capsule.

4. Loosely install the clamp screw that secures the flex coupling upper flange to the steering shaft.

5. Install finger tight the screw and lockwasher that secure the lower mounting bracket to steering column jacket.

6. Install finger tight the screws and flatwashers that attach the lower mounting bracket to the toe pan. On Eldorados, install lower steering shaft as described in Note 26b.

7. Align column and tighten support bolts as described in Note 6 under steering column alignment.

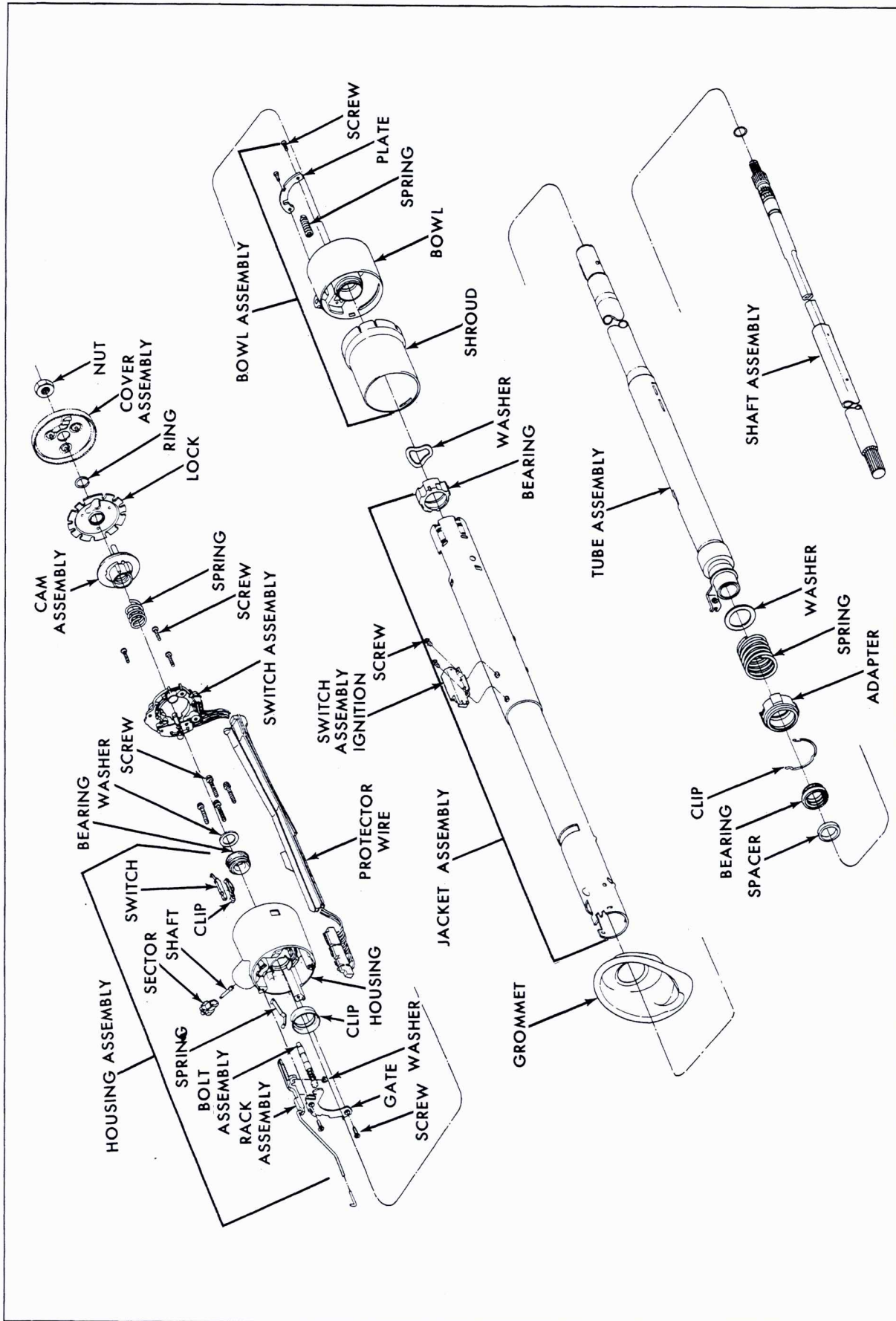


Fig. 9-42 Steering Column Disassembled

8. Align toe pan seal and retainer with column and floor and secure with five screws.

9. Replace carpet and secure with two screws. Slide steering column rubber cover in place.

10. Install screw and lockwasher that secure lower shift lever to column.

CAUTION: Make sure that lever support on column does not bend or twist during tightening.

11. Install transmission shift indicator and tighten screw.

12. Perform transmission linkage adjustment as described in Section 7, Note 4, for all except 693 and Note 22 for 693.

13. Adjust neutral and back-up light switch as described in Section 12, Note 41.

14. Install steering column lower cover as described in Section 12, Note 54b.

20. Standard Steering Column Disassembly, Inspection and Assembly (Fig. 9-42)

NOTE: Extreme care must be taken when working on the column as certain parts of the assembly can be damaged if not handled correctly.

a. Disassembly

NOTE: Remove steering column from car as outlined in Note 19 for most disassembly operations.

1. Remove steering wheel as described in Note 18a.

2. Remove three screws securing lock plate cover assembly to lock plate and remove cover assembly, Fig. 9-43.

3. Install Spring Compressor, J-23131, on steering shaft, Fig. 9-44.

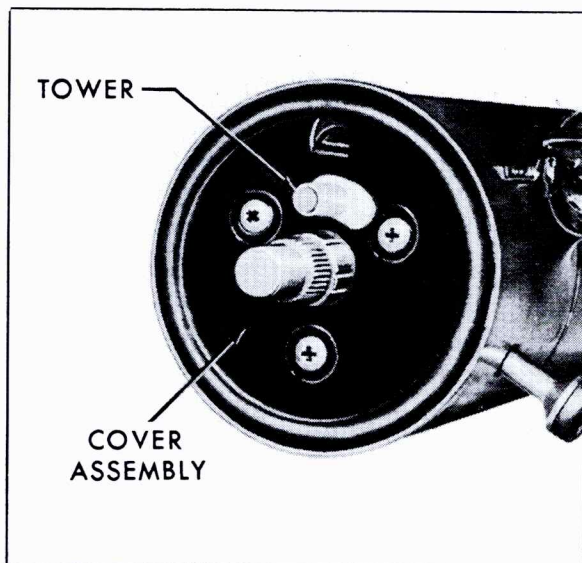


Fig. 9-43 Cover Plate and Tower

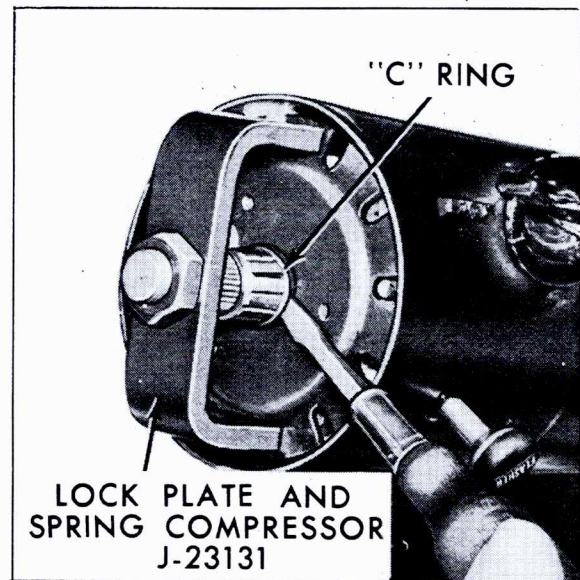


Fig. 9-44 Removing and Installing C-Ring

4. Compress lock plate and spring and remove snap ring from groove in shaft, Fig. 9-44. Discard snap ring.

CAUTION: The shaft should slide out bottom of column when snap ring is removed.

5. Remove lock plate by sliding plate up and off upper shaft.

6. Slide turn signal cancelling cam and upper bearing preload spring off upper steering shaft.

7. Slide thrust washer off upper steering shaft.

8. Remove turn signal lever screw and remove turn signal lever.

NOTE: If car being worked on is an Eldorado equipped with Cruise Control, perform the following procedure.

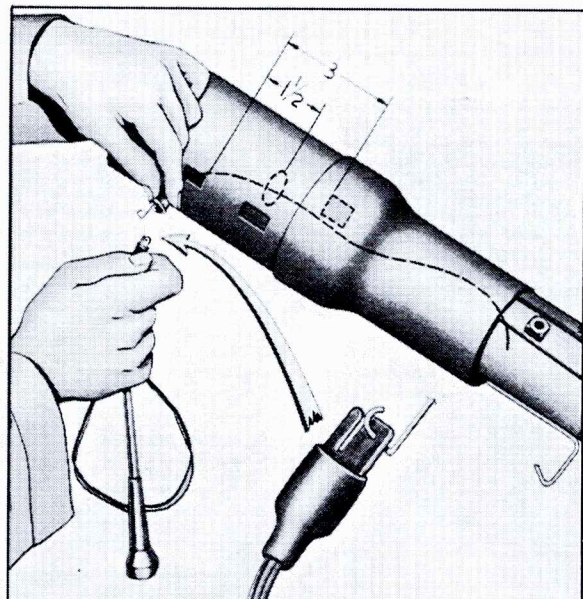


Fig. 9-45 Removing Cruise Control Harness

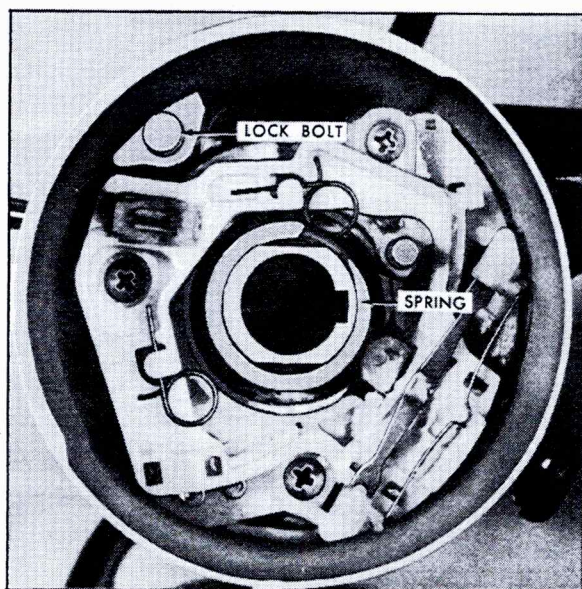


Fig. 9-46 Turn Signal Switch

- a. Disconnect connector on lower steering column jacket.
- b. Attach a long piece of piano wire to connector on Cruise Control harness, Fig. 9-45.
- c. Using extreme care, gently pull Cruise Control harness up through and out of column.
- d. Remove piano wire from harness connector and secure lower end of piano wire to steering column.

NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column over wire, to permit locating passage.

9. Push Hazard Warning Switch in, unscrew knob and remove knob from column.

10. Remove three turn signal switch mounting screws, Fig. 9-46.

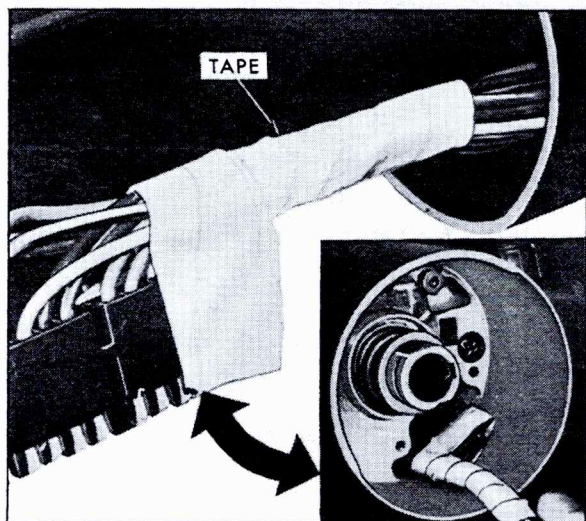


Fig. 9-47 Taping Connector

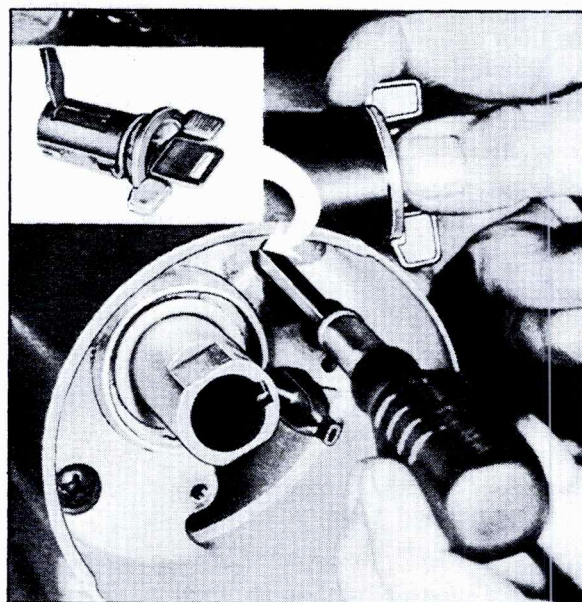


Fig. 9-48 Removing Lock Cylinder

11. Slide turn signal switch connector out of bracket on steering column jacket and disconnect connector using a small screwdriver to release lock tangs.

12. Wrap a piece of tape around the turn signal switch connector and harness, Fig. 9-47, to facilitate removal.

13. Remove four bolts that secure upper mounting bracket to steering column and remove bracket.

14. Free turn signal switch wiring protector from bracket mounting bosses on upper column jacket.

15. Pull turn signal switch straight up with wire protector attached and remove switch, switch harness and connector from column, Fig. 9-47.

16. Turn ignition switch to the "ON" or "RUN" position.

17. Insert a small, thin screwdriver into slot next to the switch mounting screw boss, Fig. 9-48. Gently tap on screwdriver until screwdriver breaks through thin wall of casting. Depress lock cylinder retaining tab with screwdriver and remove lock cylinder.

18. Using a piece of stiff wire, (such as a paper clip) hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-49. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

19. Remove two screws securing ignition switch to lower steering column jacket. Slide switch off actuator rod and remove switch from column.

20. Support upper end of steering column and drive out shift lever pivot pin. Remove shift lever.

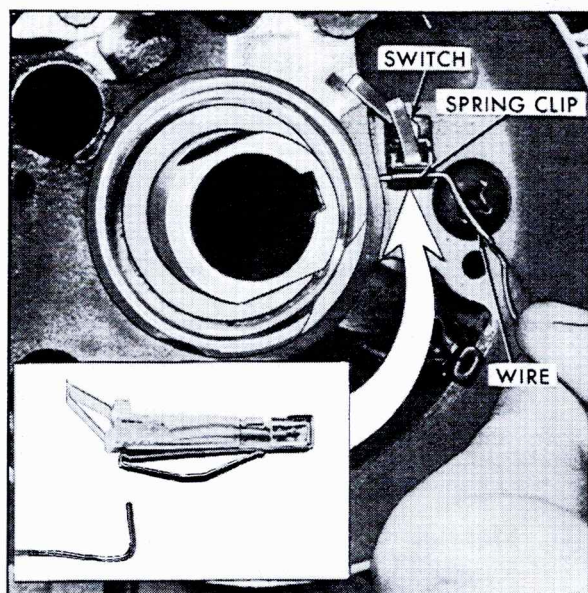


Fig. 9-49 Removing Buzzer Switch

b. Upper Housing Disassembly (Fig. 9-42) (On Bench)

1. Place shift bowl in park position.
2. Remove four screws securing upper housing assembly to steering column jacket and remove housing assembly.
3. Remove rack, lock bolt, and sector following the procedure outlined below:
 - a. Push sector off support shaft by lightly tapping in direction of cylinder bore.
 - b. Remove rack and lock bolt from housing.

c. Shift Bowl and Shift Tube Disassembly

These parts are not to be removed from outer jacket. Where servicing is required, replace with complete shift bowl, shift tube and outer jacket assembly.

d. Steering Shaft Removal (On Bench)

1. Using a screwdriver, remove lower bearing adapter retaining clip.
2. Slide lower bearing reinforcement collar, bearing adapter and bearing, shift tube spring, and washer off shift tube and out of jacket.
3. Remove steering shaft from lower end of column.

e. Steering Shaft Installation (On Bench)

1. Install washer, shift tube spring, bearing adapter with bearing installed and reinforcement collar onto lower end of column.
2. Hold bearing adapter and reinforcement collar in position and install retaining clip in slots in steering column jacket.
3. Slide steering shaft up into column from lower end.

CAUTION: Take care not to hit the drive tab on the neutral and back-up switch assembly when sliding shaft up through column.

f. Upper Housing Assembly (Fig. 9-42) (On Bench)

NOTE: If column is an Eldorado column equipped with Cruise Control, assemble parts over piano wire used for disassembly to assure proper installation of Cruise Control harness.

1. Install rack and lock bolt assembly into the housing from the lower end of housing, making sure that plastic spring seat is between spring and arm of rack.
2. Install sector onto support shaft through lock cylinder hole with drive tang end of sector facing out. Press the sector onto shaft with a blunt punch.

CAUTION: Make sure wide tooth on sector lines up with wide gap at bottom end of rack.

3. Install ignition switch actuator rod through shift bowl and position housing on shift bowl. Secure housing to outer jacket with four screws. Torque to 60 inch-pounds.

CAUTION: Make sure plastic thrust cup is on bottom hub of housing before installing housing onto shift bowl.

4. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch.
5. Push switch and spring into hole in housing with switch contacts pointing toward the center of the column and up.
6. Hold lock cylinder sleeve and rotate key clockwise against stop when viewed from key end. Make sure buzzer switch drive tang is below O.D. of lock cylinder.
7. Insert ignition lock cylinder and sleeve assembly into housing bore with key on cylinder sleeve aligned with keyway in housing. Maintaining a light push inward on cylinder, push until drive section of cylinder touches sector.
8. Rotate key counterclockwise while maintaining inward pressure until lock sector drive engaged sector drive. Then, push in until snap ring pops into grooves and lock cylinder is secured in housing. Check freedom of lock cylinder rotation. There must be a free spring return from "start" to "run" position.
9. Assemble ignition switch on actuator rod and adjust to the "lock" position.

NOTE: The lock position can be found by holding the switch actuating rod stationary with one hand, then moving the switch towards the bottom of the column with the other hand until the end of travel in the switch has been reached. This is the accessory position. Next back off one detent in the switch and this will be the lock position. Make sure the ignition key is in the lock position, then assemble the ignition switch to the column using the two screws provided. Take care to assure proper engagement of drive

rod and switch slider without moving from "lock" position. Tighten screws to 35 inch pounds.

CAUTION: Use only those screws provided for the ignition switch.

10. Install turn signal switch, feeding the harness, connector and harness protector down through the housing, Fig. 9-47.

11. Position turn signal switch in neutral position and install three screws securing switch to upper housing, Fig. 9-46. Tighten screws to 35 inch-pounds.

12. On Eldorados equipped with Cruise Control, perform the following procedure:

a. Connect Cruise Control harness connector to piano wire used on removal, Fig. 9-45.

b. Using a piece of heavy paper, make a funnel over the harness connector and piano wire connection.

NOTE: The small end of the funnel must be fed into the column first.

c. After the funnel has been formed over the connection, wrap the funnel with tape to prevent tearing the paper when installing the harness.

NOTE: Funnel is required to act as a guide for the harness and to prevent damage to the harness and harness connector on installation.

d. Feed Cruise Control harness into turn signal lever opening in steering column housing assembly. Next, gently pull on piano wire and pull Cruise Control harness through the steering column and into position.

e. Remove tape and funnel from harness.

f. Remove piano wire from harness connector.

g. Position turn signal lever on turn signal switch and secure lever to switch with one screw. Tighten screw to 30 inch-pounds.

h. Connect Cruise Control harness to connector mounted on the lower steering column jacket.

13. Position turn signal switch wiring protector over upper bracket mounting bosses on upper steering column.

14. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws. Tighten screws to 20 foot-pounds.

15. Remove tape from turn signal switch wiring harness and connector.

16. Connect turn signal switch to connector and install connector in bracket on steering column upper jacket.

17. Install Hazard Warning switch knob.

18. Position turn signal lever on switch and install one screw securing lever to turn signal switch.

19. Install thrust washer on steering shaft.

20. Install upper bearing preload spring and turn signal canceling cam.

21. Install lock plate with large flat on plate aligned with large flat on steering shaft.

22. Place a new snap ring on upper end of steering shaft.

23. Install Spring Compressor, J-23131, on steering shaft, Fig. 9-44.

24. Compress lock plate and spring. Next slide new snap ring down shaft until ring locks in groove in upper end of shaft. Remove spring compressor tool.

25. Position cover assembly on upper end of column and install three screws securing cover to lock plate.

26. Install steering wheel as described in Note 18b.

27. Plug horn contact into plastic tower.

28. Position steering wheel cover on steering wheel and secure cover to wheel with three screws.

29. Install steering column into car as outlined in Note 19b.

21. Steering Column Lower Bearing Removal (Except 693)

a. Removal

1. Raise car.

2. Remove clamp screw that secures flexible coupling upper flange to steering column shaft.

3. Remove three screws that hold steering gear to frame side rail.

4. Lower steering gear and position on Y-pipe, being careful not to damage hoses.

5. Remove lower bearing retaining spring clip by prying off shaft and discard clip.

6. Slide nylon bushing off end of shaft.

7. Remove lower bearing adapter retaining ring and reinforcement collar.

8. Remove lower bearing and adapter assembly.

9. Pry bearing assembly out of adapter and discard bearing.

b. Installation

1. Install new lower bearing into bearing adapter.

CAUTION: Make certain that bearing is properly seated in adapter.

2. Install bearing and adapter on shaft and up into steering column lower jacket.

3. Install reinforcing collar over end of jacket.

4. Install retaining ring that holds adapter and collar to jacket.

5. Install plastic sleeve bushing over end of shaft.

6. Install new spring clip on shaft to hold sleeve in position.

7. Place steering gear into position on frame side rail with flexible coupling upper flange properly positioned on end of column shaft.

8. Install three gear housing to frame mounting screws and tighten to 60 foot-pounds.

9. Install screw and lockwasher that clamps flexible coupling to column shaft and tighten to 30 foot-pounds.

10. Lower car.

STEERING GEAR AND PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Pump Noise Chirp	Loose belt.	Adjust belt tension to specification.
Squeal	Loose belt.	Adjust belt tension to specification.
Rattle	Pressure hose touching other parts of car.	Adjust hose position.
Groan	Low oil level.	Fill reservoir to proper level.
Groan	Air in the oil. Poor pressure hose connection.	Bleed system by operating steering from right to left - full turn.
Growl	Excessive back pressure caused by hoses or steering gear.	Locate restriction and correct. Replace part, if necessary.
Growl	Scored pressure plates, thrust plate or rotor.	Replace parts.
Rattle	Vanes not installed properly.	Install properly.
Rattle	Vanes sticking in rotor slots.	Free up by removing burrs, varnish or dirt.
Growl	Extreme wear of cam ring.	Replace parts.
Swish	Defective flow control plunger.	Replace part.
Whine	Pump shaft bearing scored.	Replace housing and shaft.
Excessive Wheel Kick-Back or Loose Steering	Backlash in steering linkage. Air in system. Excessive "on-center" lash. Loose thrust bearing preload adjustment. Worm and ball preload. Worn poppet valve. Steering gear loose on frame. Steering gear flexible coupling too loose on shaft or rubber disc mounting screws loose. Steering linkage spherical joints worn enough to be loose. Front wheel bearings incorrectly adjusted or worn.	Adjust parts affected or replace worn parts. Add oil to pump reservoir and bleed by operating steering. Adjust to specification. Adjust to specification. Remove rack-piston and worm. Inspect for worn parts and replace as necessary. Replace valve. Tighten attaching screws to 60 foot-pounds. Tighten retaining screws to 30 foot-pounds. Tighten mounting bolts to 15 foot-pounds. Replace loose pivots. Adjust bearings or replace with new parts as necessary.
Poor Return of Steering	Frozen steering shaft bearings. Lower coupling flange rubbing against steering gear adjuster plug. Steering wheel rubbing against directional signal housing. Tires over-inflated. Steering linkage binding.	Replace bearings. Loosen screw and assemble properly. Adjust steering jacket. Inflate to specified pressure. Replace pivots.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Poor Return of Steering (Cont'd.)	Steering gear to column misalignment. Tie rod pivots not centralized. Lack of lubricant in suspension spherical joints. Steering gear adjustments tight. Sticky or plugged valve spool. Rubber spacer binding in shift tube. Tight steering shaft bearings. Improper front wheel alignment. Steering shaft rubbing ID of shift tube.	Align steering column. Adjust tie rod ends as required to center pivots. Replace seal and repack. Check adjustment with pitman arm disconnected. Readjust if necessary. Remove and clean or replace valve. Make certain spacer is properly seated. Lubricate inside diameter with silicone. Replace bearings. Check and adjust as necessary. Align column.
Steering Gear External Oil Leaks (Wipe gear thoroughly and make sure source of leakage is determined)	Loose hose connections. Damaged hose or connector seat. Side cover O-ring seal. Pitman shaft seals. Housing end plug seal. Adjuster plug seals. Torsion bar seal. Defective housing.	Tighten. Replace hose. Replace seal. Replace seals. Replace seal. Replace seals. Replace complete valve assembly. Replace housing.
Gear Noise (Rattle or Chuckle)	Loose pitman shaft adjustment. NOTE: A slight rattle may occur on turns because of increased clearance off the "high point". This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle. Gear loose on frame. Steering linkage looseness.	Adjust to specifications. Check gear-to-frame mounting screws. Tighten screws to 60 foot-pounds. Check linkage pivot points for wear. Replace if necessary.
Car Leads to One Side or the Other. (Keep in mind road condition and wind. Test car on flat road going in both directions)	Front end misaligned. Unbalanced or badly worn steering gear valve. NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction. Steering linkage not level.	Adjust to specifications. Replace valve. Adjust as required.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Steering Wheel Surges or Jerks When Turning With Engine Running Especially During Parking	Loose pump belt. Sticky flow control valve. Steering linkage hitting engine oil pan at full turn. Insufficient pump pressure.	Adjust tension to specification. Inspect for varnish or damage, replace if necessary. Correct clearance. Replace relief valve.
Pump Leaks	Top of reservoir: Reservoir too full. Air in oil. At reservoir: O-ring cut. O-ring improperly installed. At pressure union or cover screw: Not tightened sufficiently. Cross threaded or damaged seat. Defective seat on hose end. Damaged seals. Loose hose connections. At shaft seal: Defective seal. Damaged shaft. Leaks in metal part.	Fill to proper level. Bleed system by operating steering. Replace O-ring. Install properly. Torque to specifications. Replace damaged parts. Replace hose. Replace seals. Tighten to specifications. Replace seal. Replace shaft. Inspect housing bushing for wear. Replace defective part.
Momentary Increase in Effort When Turning Wheel Fast to Right or Left.	Low oil level in pump. Pump belt slipping. High internal leakage.	Check oil level in pump reservoir. Tighten or replace belt. Check pump pressure.
Hard Steering or Lack of Assist	Loose pump belt. Low oil level in reservoir. Lack of lubricant in suspension spherical joints. Tires not properly inflated. Flexible coupling distorted. Steering gear to column misalignment. Improper front and rear wheel alignment.	Adjust belt tension to specification. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Replace seal and repack spherical joint. Inflate to recommended pressure. Loosen bolts and assemble properly. Align steering column. Check and adjust as necessary.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Hard steering or Lack of Assist (Cont'd)	Steering gear adjusted too tight.	Test steering system for binding with front wheels off floor. Adjust as necessary.
	Excessive friction in steering linkage.	Check tie rod pivot points for excessive friction. Replace the affected pivot.
	Excessive caster or toe-in.	Adjuster caster and toe-in to specifications.
	Incorrect camber.	Check and adjust to specifications.
	Suspension arms bent or twisted.	Check wheel camber and caster. Replace bent arms with new ones.
	Lower spherical joints too tight.	Replace joints.
	Upper spherical joints too tight.	Replace arm assembly.
	Steering knuckle bent.	Replace with new knuckle.
	Frame bent or cracked.	Check frame for proper alignment or cracking. Repair or replace as necessary.
	Front springs weak and sagging.	Checking standing height. Weak or sagging springs should be replaced with new ones.
	Insufficient oil pressure.	If above checks do not reveal cause of hard steering, check pump pressure.
	Low oil pressure due to restriction in hoses:	
	Check for kinks in hoses.	Remove kink.
	Foreign object stuck in hose.	Remove hoses and remove restricting object or replace hose.
	Low oil pressure due to steering gear:	
	Pressure loss in cylinder due to worn piston ring or scored housing bore.	Remove gear from car for disassembly and inspection of ring and housing bore.
	Leakage at valve rings, valve body to worm seal.	Remove gear from car for disassembly and replace seals.
	Loose fit of spool in valve body or leaky valve body.	Replace valve.
	Damaged poppet valve.	Replace valve.
	Low oil pressure due to steering pump:	
	Loose belt.	Adjust tension to specification.
	Low oil level.	Fill reservoir to proper level.
	Air in the oil.	Locate source of leak and correct. Bleed system.
	Defective hoses or steering gear.	Correct as necessary.
	Flow control valve stuck or inoperative.	Remove burrs or dirt or replace.
	Loose screw in end of flow control valve.	Tighten.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Hard Steering or Lack of Assist (Cont'd.)	Pressure plate not flat against cam ring. Extreme wear of cam ring. Scored pressure plate, thrust plate or rotor. Vanes not installed properly. Vanes sticking in rotor slots.	Correct. Replace parts. Replace parts. (If rotor, replace with rotating group kit). Install properly. Free-up by removing burrs, varnish or dirt.
Gear Noise ("His-sing" Sound)	There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Do not replace valve unless "hiss" is extremely objectionable. Slight "hiss" is normal and in no way affects steering. A replacement valve will also exhibit slight noise and is not always a cure for the objection. Investigate clearance around flexible coupling screws. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal-to-metal contacts through flexible coupling will transmit valve "hiss" into car.

STANDARD COLUMN DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Lock system will not unlock.	Sector collapsed. Lock bolt damaged. Defective lock cylinder. Damaged housing.	Replace. Replace. Replace. Replace.
Lock system will not lock.	Lock bolt spring broken or defective. Damaged sector tooth. Defective lock cylinder. Burr on lock bolt or housing. Damaged housing. Transmission linkage adjustment incorrect.	Replace. Replace. Replace. Remove burr. Replace. Readjust.

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
High effort.	Lock cylinder defective. Ignition switch defective. Rack preload spring broken or deformed. Burrs on sector, rack or housing. Bent sector shaft. Actuator rod restricted.	Replace. Replace ignition switch. Replace. Remove burr. Replace housing assembly. Remove restriction.
High effort on lock cylinder between "OFF" and "OFF-LOCK".	Burr on tang of shift gate. Distorted rack.	Remove burr. Replace rack.
Sticks in "START".	Actuator rod deformed. Any high effort condition.	Straighten or replace. Check items under high effort section.
Lock bolt hits shaft lock in "OFF" position in "PARK".	Ignition switch is not set correctly.	Readjust ignition switch.
Key cannot be removed in "OFF-LOCK".	Ignition switch is not set correctly. Defective lock cylinder.	Readjust. Replace.
Will lock in any shift position.	Bowl plate has been omitted.	Replace.
Lock cylinder can be removed without depressing retainer.	Lock cylinder retainer defective. Lock cylinder retainer missing. Burr over retainer slot in housing.	Replace. Install. Remove burr.
Ignition system electrical system will not function.	Defective fuse in "ACCESSORY" circuit. Connector body loose or defective. Defective wiring. Defective ignition switch.	Replace. Tighten or replace. Repair or replace. Replace.

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Switch will not actuate mechanically.	Defective ignition switch.	Replace.
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace.
Buzzer system buzzer will not function.	Defective buzzer switch.	Replace.
	Defective switch retainer.	Replace.
	Defective terminals on signal switch.	Replace.
	Dog on lock cylinder defective.	Replace lock cylinder.
	Buzzer switch wedged in tapered hole in housing.	Remove burrs in hole and replace switch.
	Door switch failed.	Replace.
Buzzer on continuously.	Buzzer plunger on lock cylinder is defective.	Replace lock cylinder.
	Defective buzzer switch.	Replace.
	Short in buzzer terminals or wires of signal switch.	Repair or replace.
	Short in door switch.	Replace.
Signal switch hazard warning, lane change or signal switch without power.	Defective fuse, bulb or flasher.	Replace.
	Poor connector body connection with main wiring harness.	Repair.
	Defective signal switch.	Replace.
Turn signal switch not cancelling from either turn position.	Flat detent spring displaced or broken.	Replace spring.
	Broken or missing cancelling springs on signal switch.	Replace springs.
	Defective cancelling cam lobes.	Replace cam.
	Defective signal switch.	Replace.

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Turn signal wires shorted out.	Wires shorted to each other or to column. (On reassembly, check for burrs and sharp edges.) Defective signal switch.	Repair or replace. Replace.
Signal switch assembly loose.		Tighten three mounting bolts to 30-40 in. lbs. Tighten handle screw to 25-30 in. lbs. Replace signal switch. Replace hub nut.
Hazard warning knob loose.		Tighten knob to 2-5 in. lbs. Replace signal switch.
Noise in the column.	Coupling bolts not tightened. Horn contact ring not lubricated. Lack of grease on bearings or bearing surface. Lower shaft bearing failed. Upper shaft bearing failed. Shaft lock plate cover loose. Shaft lock snap ring not seated. Defective buzzer dog cam on lock cylinder.	Tighten pinch bolts to 25-35 in.-lbs. Tighten coupling bolts to 25-35 in.-lbs. (Parts should be inspected for damage before reassembly. If serrations or threads are damaged, replace parts.) Lubricate with Lubriplate or equivalent. Lubricate. Replace bearing. Check shaft and replace if scored. Replace housing assembly. Tighten three screws or, if missing, replace. CAUTION: Use specified screws. Replace snap ring. Check for proper seating in groove. Replace lock cylinder.
One click when in "Off-Lock" position and the steering wheel is moved.	Normal - lock bolt is seating.	
High steering shaft effort.	Column assembly misaligned in car.	Realign.

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
High steering shaft effort. (Cont'd.)	Improperly installed or deformed dust seal.	Remove and replace.
	Defective upper or lower bearing.	Replace.
High shift effort.	Column not aligned correctly in car.	Realign.
	Lower bowl bearing not assembled correctly.	Reassemble correctly.
	Improperly installed dust seal.	Remove and replace.
	Wave washer in lower bowl bearing defective.	Replace.
	Lack of grease on seal or bearing areas.	Lubricate.
Improper transmission shifting.	Sheared shift tube joint.	Replace tube assembly.
	Improper transmission linkage adjustment.	Readjust.
	Loose shift lever.	Replace shift tube assembly.
	Improper gate plate.	Replace with correct part.
Miscellaneous.	Shroud loose on shift bowl.	Bend tabs on shroud over lugs on bowl.
	Housing loose on jacket - will be noticed with ignition in "OFF-LOCK" and a torque applied to the steering wheel.	Tighten four mounting screws.
Lash in mounted column assembly.	Instrument panel mounting bolts loose.	Tighten.
	Broken weld nuts on jacket.	Replace jacket assembly.
	Instrument panel bracket capsule sheared.	Replace bracket assembly.

22. Correcting Excessive Rotational Lash on Tilt and Telescoping Wheel (On Car)

Excessive rotational lash in the tilt and telescoping column results in a loose steering feel, a "chucking" noise, or a rattle from the upper

steering column area while driving over certain road surfaces. This lash may be caused by a mis-adjusted telescope locking lever or by the plastic centering sphere.

NOTE: When the locking lever is securely locked, it should not contact the steering wheel

spoke. If necessary, adjust as described in Note 18. If it is thought that excessive lash still exists, proceed as follows:

1. Remove three screws securing steering wheel cover to steering wheel and remove cover.
2. Lift tilt lever and place wheel in center position.
3. Place a wood block or some other stable support on front floor carpeting below wheel. On the support, position Dial Indicator, J-8001, with its stem at outboard end of steering wheel spoke using Dial Indicator Support, J-6126, and part of Clutch Piston Actuator Set, J-4353.
4. Have helper hold lower shaft with self-clamping pliers between the flexible coupling and the shift tube, lock the lower shaft.
5. Install a torque wrench on steering wheel hub nut.

6. Try to rotate the steering wheel in clockwise and counterclockwise directions. Note the dial indicator reading. Next, repeat this same operation using the torque wrench on the hub nut and note torque reading. If dial indicator reading shows rotational lash to be more than .032 inch, or torque wrench reading more than 3-1/2 inch-pounds, the excessive lash can be corrected by installing shims between the center sphere halves.

The shims resembling cross section of centering sphere, are available from Cadillac Parts Warehouses in a kit.

One or more shims may be used as required, depending on the excess lash.

CAUTION: Remove sphere preload spring before installing shims. This preload spring cannot be used when shims are installed. If additional shims are necessary, a second shim kit may be required.

7. After shims are installed, position wheel in full down tilt position and check lash again.

NOTE: Lash must not exceed 3-1/2 inch-pounds after shims are installed.

23. Lock Cylinder Service

a. Lock Cylinder Tumblers

New lock cylinders for duplicating ignition locks are available from your Parts Distribution Center, with the locking bar staked in place. Tumblers are also available, but must be assembled into the cylinder according to the following special code.

When it is necessary to assemble a new lock cylinder to agree with a key code number, install the proper tumblers into their respective slots as indicated by Key Code Diagram, Fig. 9-50 or a code list.

Tumblers of all ignition locks are shaped exactly alike, with the exception of the position of a notch on one side. As the key is inserted in the lock cylinder, the tumblers are raised to the correct height so that the notches on each tumbler are on the same level. When the notches on all six

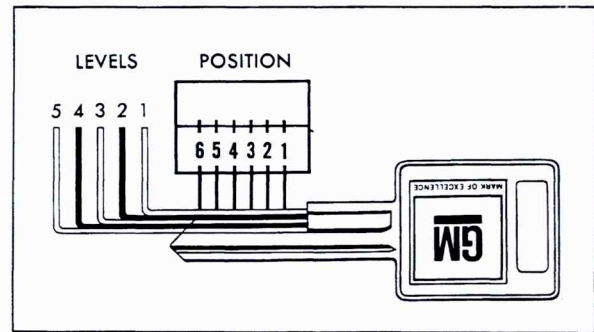


Fig. 9-50 Key Code Diagram

tumblers line up, the locking bar is pushed into the notches by two small springs, allowing the cylinder to turn in its bore. Five types of tumblers are used to make all the various lock tumbler combinations and each is coded according to a number 1 through 5, stamped on its side. Refer to Note b, to assemble all lock cylinders.

To determine which tumblers should be installed in what position for a given key, when a code list is not available, proceed as follows:

1. Lay the key on the Key Code Diagram, Fig. 9-50, with the key outlined by the diagram as accurately as possible.
2. Starting at the base of the key blade, determine the lowest level that is visible in position #1.
3. Determine the lowest visible level for the remaining five positions. As each tumbler level is determined, write the number in the blank space provided above the position numbers.
4. Cuts that fall in the first white section, mark level #1 on top of appropriate position number.
5. Cuts that fall in the first black section, mark #2 on top of appropriate position number.
6. Cuts that fall in the second white section, mark #3 on top of appropriate position number.
7. Cuts that fall in the second black section, mark #4 on top of appropriate position number.
8. Cuts that fall in the third white section, mark #5 on top of appropriate position number.

b. Assembling Lock Cylinder

After the tumbler arrangement has been determined as shown in Note a, ignition and door lock cylinders should be assembled as follows:

1. Hold cylinder with head of cylinder away and starting at the head of the cylinder, insert the tumblers in their proper slots in the order called for by the code, ribbed side toward you and long point down.
2. Insert one tumbler spring in the space provided above each tumbler.

CAUTION: If the springs become tangled, do not pull them apart -- unscrew them.

3. Reverse the lock cylinder so that the head of the cylinder is now toward you. Insert the spring retainer so that the two end prongs slide into the slots at either end of the cylinder. Press the retainer down.

4. To check insert proper key. If tumblers are installed properly, the side bar will be allowed to drop down. If bar does not drop down, remove the key, spring retainer, springs and tumblers and reassemble correctly.

NOTE: If the tumblers have not been assembled correctly, they can be removed from the cylinder by holding it with the tumbler slots down, pulling the locking bar out with the fingers and jarring the cylinder to shake the tumblers out. This procedure is necessary because once the tumblers have been pressed down into the cylinder, they are held in their slots by the locking bar.

5. If, after checking, the lock is found to be assembled properly, remove key and secure cylinder in a vise with spring retainer exposed. Use leather or wood to cover each vise jaw to prevent damage to the cylinder.

6. Stake the retainer securely in place by staking the cylinder metal over both edges at each retainer end, using a suitable staking tool at right angles to the top of the retainer.

24. Tilt and Telescope Column Disassembly, Inspection and Assembly (Fig. 9-51)

NOTE: Extreme care must be taken when working on the column as certain parts of the assembly can be damaged if not handled correctly.

a. Disassembly

NOTE: Remove steering column from car for most disassembly operations. Follow procedure outlined in Note 19.

1. Remove steering wheel as described in Note 18a.
2. Remove rubber bump stop.
3. Install spring compressor, J-22191, on steering shaft, Fig. 9-52.

NOTE: When installing spring compressor, pull upper steering shaft up one inch and hold shaft in this position until tool is installed.

4. Compress upper steering shaft preload spring and remove C-ring, Fig. 9-52.
5. Remove spring compressor tool and remove lock plate, horn contact assembly and upper steering shaft preload spring.
6. Slide turn signal switch connector out of bracket on steering column jacket and disconnect connector.
7. Wrap a piece of tape around the upper part of the turn signal switch connector and harness, Fig. 9-47.
8. Remove four bolts that secure upper mounting bracket to steering column and remove bracket.
9. Remove turn signal switch wiring protector

from boss on upper column, located under the column upper mounting bracket.

10. Position shift bowl in the "Park" position.
11. Unscrew turn signal lever and remove lever from column.

NOTE: On Eldorados equipped with Cruise Control, perform the following procedure:

- a. Disconnect turn signal switch and Cruise Control connectors on steering column jacket.
- b. Attach a long piece of piano wire to connector on Cruise Control harness, Fig. 9-45.
- c. Using extreme care, unscrew turn signal lever and gently pull Cruise Control harness up through and out of column.
- d. Remove piano wire from harness connector and secure lower end of wire to steering column, Fig. 9-45.

NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column over wire to permit locating passage.

12. Push Hazard Warning Flasher button in. Unscrew button and remove from column.
13. Remove three screws securing turn signal switch to housing assembly.
14. Pull turn signal switch straight up with wire protector attached and remove switch, switch harness and connector from column, Fig. 9-47.
15. Turn ignition key to the "ON" or "RUN" position.
16. Insert a small thin screwdriver into the slot next to switch mounting screw boss, Fig. 9-48. Gently tap on screwdriver until screwdriver breaks through thin wall of casting. Depress lock cylinder retaining tab with screwdriver and remove lock cylinder.
17. Using a piece of stiff wire, hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-49. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

18. Remove tilt release lever.
19. Remove three screws securing cover to upper housing and remove cover.
20. Install tilt release lever and position housing in the full up position.
21. Using a wide blade screwdriver, remove tilt spring by turning cap on spring counterclockwise.
22. Install Pivot Pin Remover, J-21854-01, and remove pivot pins, Fig. 9-53.
23. Remove two screws securing ignition switch to steering column jacket. Slide switch off actuator rod and remove switch from column.
24. Pull back on tilt release lever to release upper housing tilt shoes and slide upper housing off column.

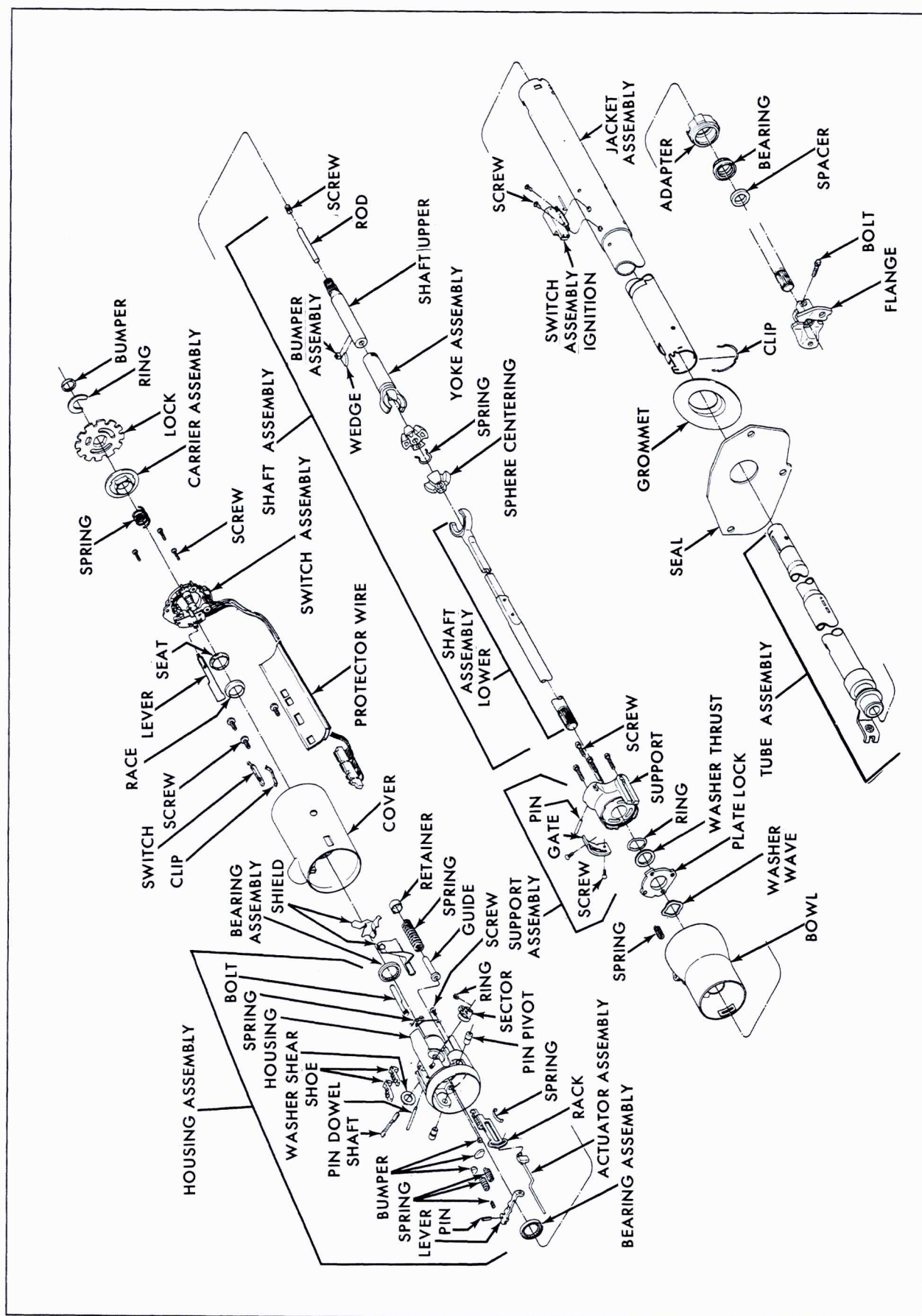


Fig. 9-51 Tilt and Telescope Column Disassembled

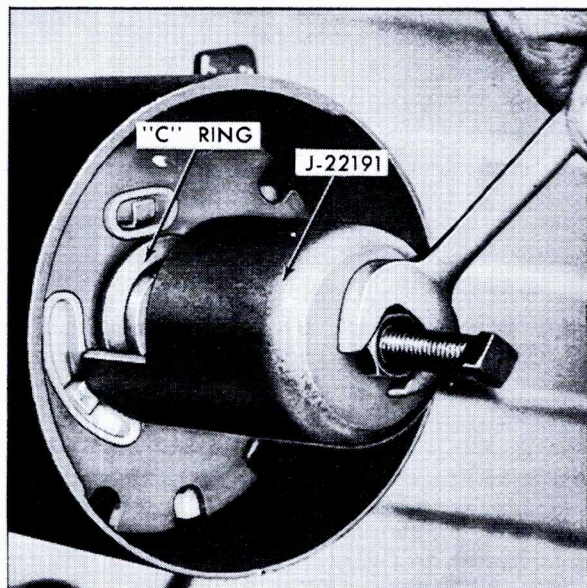


Fig. 9-52 Removing and Installing C-Ring (T & T)

b. Steering Shaft and Support Removal

(On Bench)

1. Using a screwdriver, dislodge and remove lower steering shaft spring clip.
2. Carefully pull steering shaft out of upper end of column.
3. Remove four screws securing support assembly to steering column and remove support assembly.

CAUTION: Hold hand over open end of upper shaft to prevent dropping locking rod when removing shaft assembly.

4. Turn upper shaft at a right angle to the lower shaft (90°) to disassemble the U-joint.

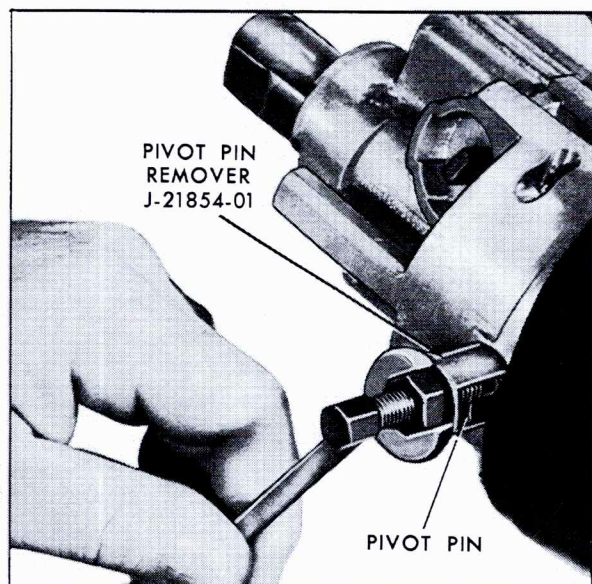


Fig. 9-53 Removing Pivot Pin

5. Remove locking rod from upper shaft.
6. Remove two-piece plastic centering sphere from upper yoke by rotating sphere so flats align with open end of yoke, then remove sphere.

c. Shift Tube Removal (On Bench)

1. Perform all operations in Note 24a and 24b.
2. Remove one screw and strap securing neutral and back-up light switch to lower steering column jacket and remove switch.
3. Using a screwdriver, remove lower bearing adapter and reinforcement collar retaining ring.
4. Remove lower steering column reinforcement collar and bearing adapter with bearing and spacer from lower end of shift tube and column.
5. Secure Shift Tube Remover, J-23072, to lock plate and remove shift tube from column, Fig. 9-54.

CAUTION: Use extreme care when removing shift tube to prevent lower shift lever arm from getting caught at lower end of column jacket resulting in separation of the lower and upper outer jackets at the collapse joint. If separation occurs then a new outer jacket assembly is required.

d. Bearing Housing Disassembly

1. Remove tilt lever opening shield and turn signal lever opening shield from housing.
2. Remove lock bolt spring by removing spring retaining screw. Then, turn spring clockwise and remove spring from bolt.
3. Remove snap ring from sector drive shaft. Using a small punch, lightly tap drive shaft out of sector.
4. Remove drive shaft, washer, sector and bolt.
5. Remove rack and rack spring.
6. Wedge shoes inward with a block between

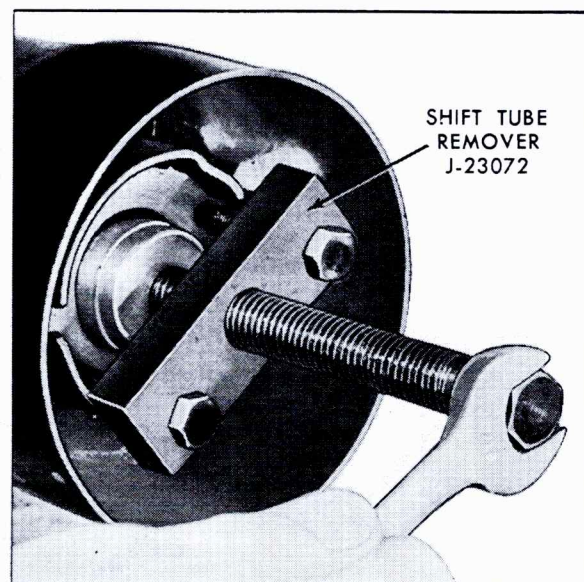


Fig. 9-54 Removing Shift Tube

of bearing housing, Fig. 9-55. Remove Pin Remover, J-22635, and remove release lever and spring.

7. Using Pin Remover, J-22635, drive out lock shoe pin. Carefully remove pin remover and remove lock shoes and springs.

NOTE: With tilt lever opening on left side and shoes facing up, the four slot shoe is on the left.

e. Inspection

1. Inspect all bearings for wear, roughness, and binding. Replace as required.
2. Inspect centering sphere for nicks, damage and wear. If damage is evident, check shaft couplings for nicks, burrs, and rough spots.
3. Inspect bearing surfaces of upper shaft for brinelling, nicks, scratches and wear.
4. Inspect rubber bumpers, making certain they are not torn or damaged.
5. Inspect telescoping mechanism for wear in key way.
6. Inspect all threads and splines for damage.
7. Inspect locking rod for straightness.
8. Inspect shift bowl for cracks.
9. Inspect steering shaft, shift tube and outer jacket for signs of damage.

NOTE: If collapse joint between upper and lower jacket shows movement or is loose, the outer jacket assembly must be replaced.

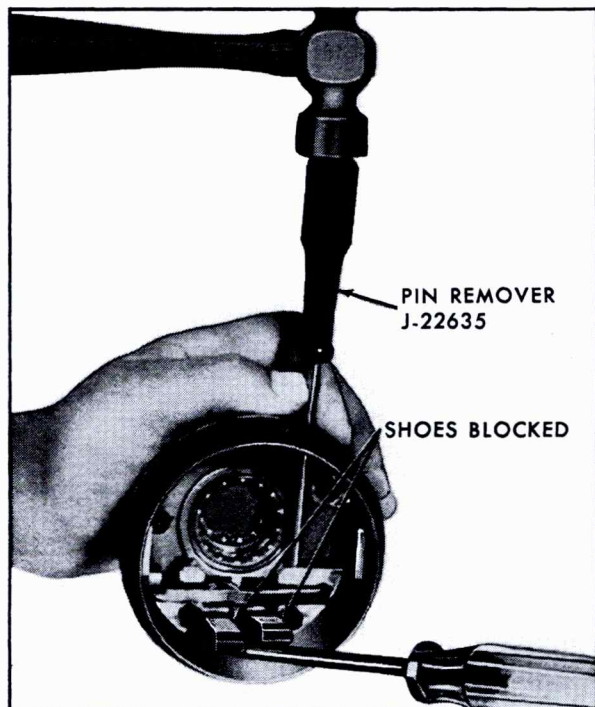


Fig. 9-55 Removing Release Mechanism

10. Inspect all other parts for damage and wear. Replace if necessary.

f. Bearing Housing Assembly

1. Apply a thin coat of lithium base (ball joint) grease to all friction parts.
2. Using Pin Remover, J-22635, to line up shoes, install lock shoe springs and lock shoes in bearing housing and retain with pin.

NOTE: With tilt lever opening in housing on left side, and shoes facing up, the four slot shoe is on the left.

3. Wedge shoes inward with a block between the top of the shoes and the bearing housing, install spring, release lever and pin in bearing housing. Remove block from shoes.
4. Install new shift lever spring in pocket of shift bowl if removed.
5. Install washer and drive shaft in housing. Then, lightly tap sector onto the shaft far enough to install snap ring. Install snap ring.
6. Install lock bolt and engage sector cam surface.
7. Install rack spring and rack.

NOTE: Block tooth on rack must engage block tooth on sector.

8. Install lock bolt spring with "U" shaped arm of spring in the large cavity of the sector and the single wire arm attached to the lock bolt. Install spring retaining screw and tighten to 35 inch-pounds.
9. If removed, install shift lever spring in bowl by winding spring up with pliers and pushing in.
10. Install tilt release lever.

g. Shift Tube Installation (On Bench)

1. Install part of Shift Tube Installer, J-23073, in shift tube, Fig. 9-56.
2. Position shift bowl on steering column.
3. Position wave washer in shift bowl.
4. Install lock plate in shift bowl.

CAUTION: Lock plate can be installed backwards. When installing plate, make sure long flat edge of plate is down and that the long tab is pointing towards the shift lever. This will position the two close spaced holes to the bottom of the bowl and the larger spaced holes to the top.

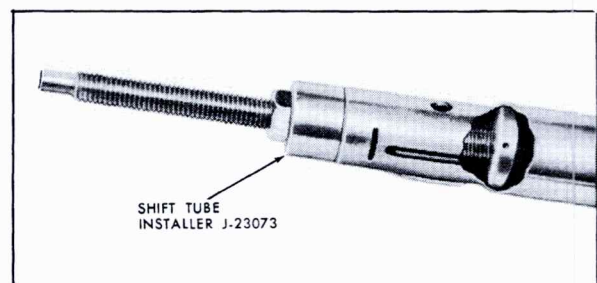


Fig. 9-56 Installing Shift Tube Installer

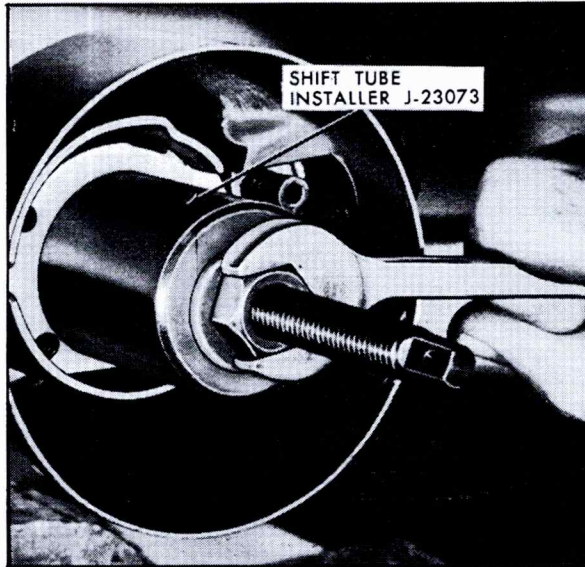


Fig. 9-56A Installing Shift Tube

5. Using a grease pencil, locate shift tube key on upper face of Shift Tube Installer, J-23073.

6. Slide shift tube up and into column from lower end of column.

7. Using alignment marks on Shift Tube Installer, J-23073, align shift tube key with keyway in shift bowl and install remaining parts of Shift Tube Installer, J-23073, Fig. 9-56A.

8. Tighten nut on Shift Tube Installer, J-23073, and install shift tube Fig. 9-56A.

CAUTION: When installing shift tube, make sure transmission linkage lever on lower end of tube is centered in slot in lower end of steering column jacket.

9. Remove Shift Tube Installer, J-23073.

10. Install thrust washer on upper end of shift tube.

11. Install snap ring on upper end of shift tube.

12. Install bearing and bearing adapter in lower end of steering column jacket.

13. Install reinforcement collar over lower end of steering column jacket and install bearing adapter retaining ring.

h. Steering Shaft and Support Assembly—Installation

1. Install support assembly by aligning "V" in support with "V" notch in jacket and install four screws securing support assembly to lock plate. Tighten screws to 60 inch-pounds.

2. Install sphere in upper yoke.

CAUTION: Make sure lash take-up spring (horse shoe in shape) is properly positioned between spheres before assembling to upper yoke.

3. Rotate centering sphere so that lower steering shaft can be installed over flats on sphere (approximately 90° from center line of upper shaft). Then install lower shaft coupling over the sphere. Make sure that mark on end of upper

shaft lines up with flat on splined end of lower shaft.

4. Position locking wedge key in upper steering shaft, align with keyway and slide upper shaft into upper yoke.

5. Install steering shaft in upper end of column.

CAUTION: If neutral and back up switch was not removed, be careful not to hit switch drive tang with end of shaft as breakage may result.

6. Install bushing and new spring clip on lower end of steering shaft.

i. Housing Cover, Lock Cylinder, Ignition Switch and Neutral and Back-Up Light Switch—Assembly

1. Position neutral and back-up light switch on lower steering column jacket.

2. Secure switch to column with one screw.

3. Adjust neutral and back-up light switch as described in Section 12, Note 41.

4. Install actuator rod in rack in housing assembly.

5. Install tilt lever in housing assembly.

6. Guide actuator rod down through shift bowl and position housing assembly on support assembly.

7. Pull back on tilt lever and engage tilt shoes in support assembly.

8. If removed, install upper bearing in housing assembly.

9. Install upper bearing inner race.

10. Align pivot pin holes and install pivot pins by tapping them in with a plastic mallet. The column must be supported to prevent any bending forces on the collapse area.

11. Tilt housing in the full UP position.

12. Position tilt spring guides, tilt spring and spring retainer in housing assembly.

13. Using a large screwdriver, press in on tilt spring retainer, compress spring and rotate retainer clockwise until retainer locks in housing.

14. Remove tilt release lever.

15. Install cover over housing assembly.

16. Install three screws securing cover to housing assembly. Tighten screws to 45 inch-pounds.

17. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch, Fig. 9-49.

18. Push switch and spring into hole in housing with switch contacts pointing toward the center of the column and up.

19. To install lock, hold lock cylinder sleeve and rotate key clockwise against stop. Make sure buzzer switch drive tang is below O.D. of lock cylinder. Insert cylinder into cover bore with key on cylinder sleeve aligned with keyway in housing until cylinder touches lock sector shaft. Maintaining a light push inward on cylinder, rotate cylinder counterclockwise until drive section of cylinder mates with sector drive shaft. Push in until snap ring on lock cylinder pops into groove in housing. Check freedom of rotation of lock cylinder in housing. There must be a free spring return from start to run position.

20. Assemble ignition switch on actuator rod and adjust to the "lock" position.

NOTE: The lock position can be found by holding the actuator rod stationary with one hand, then moving the switch toward the upper end of the column with the other hand until the end of travel in the switch has been reached. This is the accessory position. Next back off one detent in the switch and this will be the lock position. Make sure the ignition key is in the "lock" position, then assemble the ignition switch to the column using the two screws provided.

21. Install turn signal switch by feeding the harness connector, harness protector and the Hazard Warning Flasher lever down through the housing, Fig. 9-47.

22. Position turn signal switch in neutral position and install three screws securing switch to upper housing, Fig. 9-46. Tighten screws to 35 inch-pounds.

23. Install turn signal lever.

NOTE: On Eldorado's equipped with Cruise Control, proceed as follows:

a. Connect Cruise Control harness connector to piano wire used on removal, Fig. 9-45.

b. Using a piece of heavy paper, make a funnel over the harness connector and piano wire connection.

NOTE: The small end of the funnel must be fed into the column first.

c. After funnel has been formed over the connection, wrap the funnel with tape to prevent tearing the paper when installing the harness.

NOTE: Funnel is required to act as a guide for the harness and to prevent damage to the harness and harness connector on installation.

d. Wrap Cruise Control harness around turn signal lever six times, in a clockwise direction.

e. Feed Cruise Control harness into turn signal lever opening in housing cover. Next, gently pull on piano wire, pulling Cruise Control harness through the steering column and into position.

f. Maintaining a light pull on piano wire, screw turn signal lever into turn signal switch.

NOTE: After turn signal lever is installed, check to make sure Cruise Control harness is completely unwound.

g. Remove tape and paper from harness connector.

h. Remove piano wire from column.

i. Connect harness to connector on the lower steering column jacket.

24. Install upper steering shaft preload spring.

25. Install lock plate and carrier assembly.

NOTE: When installing lock plate and carrier assembly, make sure flat on lower end of steering shaft is pointing up and that the small plastic tab on the carrier is up or nearest the top of the shift bowl.

26. Install Spring Compressor, J-22191, Fig. 9-52. Compress preload spring and lock plate and install C-ring.

27. Remove Spring Compressor, J-22191.

28. Position turn signal switch harness protector over boss on upper steering column.

29. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws. Tighten screws to 20 foot-pounds.

30. Remove tape from turn signal switch wiring harness and connector.

31. Connect turn signal harness to connector and install connector in bracket on steering column jacket.

32. Install column into car as outlined in Note 19b.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Lock system will not unlock.	Shear washer collapsed.	Replace.
	Lock bolt damaged.	Replace.
	Defective lock cylinder.	Replace.
	Damaged housing.	Replace.
	Damaged sector.	Replace.
Will not lock.	Lock bolt spring broken or defective.	Replace.
	Damaged sector tooth.	Replace.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Will not lock. (cont'd)	Defective lock cylinder. Burr on lock bolt or housing. Damaged housing. Transmission linkage adjustment incorrect. Damaged rack.	Replace. Remove burr. Replace. Readjust. Replace.
High effort.	Lock cylinder defective. Ignition switch defective. Rack preload spring broken or deformed. Burrs on sector, rack, housing, support or actuator rod coupling. Bent sector shaft. Defective rack. Extreme misalignment of housing to cover. Distorted coupling slot in rack.	Replace. Replace. Replace. Remove burr. Replace housing assembly. Replace. Replace either or both. Replace rack.
Will stick in "START".	Actuator rod deformed. Any high effort condition.	Straighten or replace. Check items under high effort section.
Key cannot be removed in "OFF-LOCK" position.	Ignition switch is not set correctly. Defective lock cylinder.	Readjust. Replace.
Lock cylinder can be removed without depressing retainer.	Lock cylinder retainer defective. Lock cylinder retainer missing. Burr over retainer slot in housing cover.	Replace. Install. Remove burr.
Ignition system electrical system will not function.	Defective fuse. Connector body loose or defective. Defective wiring. Defective ignition switch.	Replace. Tighten or replace. Repair or replace. Replace.
Switch will not actuate mechanically.	Defective ignition switch.	Replace.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace.
Buzzer system will not function.	Defective buzzer switch.	Replace.
	Defective switch retainer.	Replace.
	Defective terminals on signal switch.	Replace.
	Dog on lock cylinder defective.	Replace lock cylinder.
	Buzzer switch wedged in tapered hole in housing cover.	Remove burrs in hole and replace switch.
Buzzer on continuously.	Dog on lock cylinder is defective.	Replace lock cylinder.
	Defective buzzer switch.	Replace.
	Short in buzzer terminals or wires of signal switch.	Repair or replace.
Signal switch hazard warning, lane change or signal switch without power.	Defective fuse, bulbs or flasher.	Replace.
	Poor connector body connection with main wiring harness.	Repair.
	Defective signal switch.	Replace.
Turn signal switch not cancelling from either turn position.	Flat detent spring displaced or broken.	Replace spring.
	Broken cancelling springs on signal switch.	Replace springs.
	Defective cancelling cam lobes.	Replace cam.
	Defective signal switch.	Replace.
Turn signal wires shorted out.	Wires shorted to each other or to column (on reassembly, check for burrs and sharp edges).	Repair or replace.
	Defective signal switch.	Replace.
Signal switch assembly loose.		Tighten three mounting bolts to 30-40 in.-lbs.
		Tighten handle screw to 25-30 in.-lbs.
		Replace signal switch.
Hazard Warning knob loose.		Replace signal switch.
Noise in the column.	Coupling bolts not tightened.	Tighten pinch bolts to 25-35 in.-lbs.
		Tighten coupling bolts to 25-35 in.-lbs. (Parts should be inspected for damage before reassembly. If serrations or threads are damaged, replace parts.)

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Column not correctly aligned.		Realign column.
Coupling pulled apart.		Realign column and replace coupling. Broken lower joint - replace steering shaft and realign column.
High steering shaft effort.	Column assembly misaligned in car.	Realign.
High shift effort.	Column not aligned correctly in car. Wave washer with burrs. Improperly installed dust seal. Lack of grease on seal or bearing areas.	Realign. Replace. Remove and replace. Lubricate.
Improper transmission shifting.	Sheared shift tube joint. Improper transmission linkage adjustment. Housing loose on jacket - will be noticed with ignition in "OFF-LOCK" and a torque applied to the steering wheel.	Replace tube assembly. Readjust. Tighten four mounting screws.
Lash in mounted column assembly.	Instrument panel mounting bolts loose. Broken weld nuts on jacket. Instrument panel bracket capsule sheared. Loose shoes in housing.	Tighten. Replace jacket assembly. Replace bracket assembly. Replace.
Housing scraping on bowl.	Bowl not concentric with hub or bent.	Replace bowl.
Steering wheel loose.	Excessive clearance between holes in support and pivot pin diameters. Defective anti-lash spring in spheres. Incorrect adjustment on upper bearing adjuster nut. Upper bearing race and wedge hanging up.	Replace either or both. Replace both. Readjust. Replace both.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Steering wheel loose - every other tilt position.	Loose fit between shoe and pivot pins.	Replace both.
Steering column not locking in any tilt position.	Shoe may have seized on its pivot pin.	Replace both.
	Shoe grooves may have burrs or dirt.	Replace.
	Shoe lock spring weak or broken.	Replace.
Steering wheel fails to return to top tilt position.	Pivot pins are bound up.	Replace.
	When tilt return spring is defective.	Replace.
Noise when tilting column.	Upper tilt bumpers failed.	Replace.
	Tilt spring rubbing in housing.	Lubricate.

FLEETWOOD ELDORADO STEERING

The service information that follows pertains only to the Fleetwood Eldorado. All other description, service procedures and recommendations for the Fleetwood Eldorado are the same as those for other cars as given in the first part of this section.

Steering Linkage (693)

The steering linkage on the 693, Fig. 9-57, consists of a pitman arm, idler arm, two tie rod assemblies, a one piece forged steel drag link, and a shock absorber. The pitman arm connects the left side of the drag link to the steering gear and the idler arm connects the right side of the drag link to the frame. The shock absorber connects the drag link to the frame in such a manner as to dampen vibrations in the linkage. The tie rods serve as connecting links between the drag link and the steering arms. Tie rod ends should be checked for looseness and damaged seals. Loose tie rod ends must be replaced as a unit. Tie rod seals are replaceable and any damaged seals should be replaced.

25. Steering Gear Assembly (693)**a. Removal**

1. Disconnect pressure and return line hoses from gear. Cap or tape hose fittings.
2. Raise car.
3. Remove cotter pin and nut at pitman arm.
4. Disconnect pitman arm from drag link using Puller, J-22292, Fig. 9-58.
5. Remove two bolts holding flexible coupling together.
6. Remove three screws that hold steering gear to frame side rail, move steering gear forward and downward out of car.

7. Working on bench remove pitman shaft nut and lockwasher and remove pitman arm from pitman shaft using Pitman Arm Puller, J-9172.

b. Installation

1. Place pitman arm on pitman shaft and install lockwasher and nut on pitman shaft. Tighten nut to 140 foot-pounds.
2. Position steering gear on car and secure to frame side rail with three screws and flat washers. Tighten screws to 60 foot-pounds.
3. Install bolts that hold flexible coupling together. Tighten bolts to 18 foot-pounds.
4. Install drag link to pitman arm and secure with nut and cotter pin. Tighten nut to 40-50 (maximum 55) foot-pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

26. Lower Steering Shaft (Fig. 9-59)**a. Removal**

1. Remove two bolts holding flexible coupling together.
2. Remove screw holding flexible coupling to steering gear and shift portion of flexible coupling on gear away from flange on shaft.
3. Disengage flange on shaft from flexible coupling.
4. Remove screw securing universal joint to steering shaft.
5. Remove lower steering shaft from steering column.
6. Remove flexible coupling from steering gear.
7. Remove screw securing universal joint to shaft and remove universal joint from shaft.

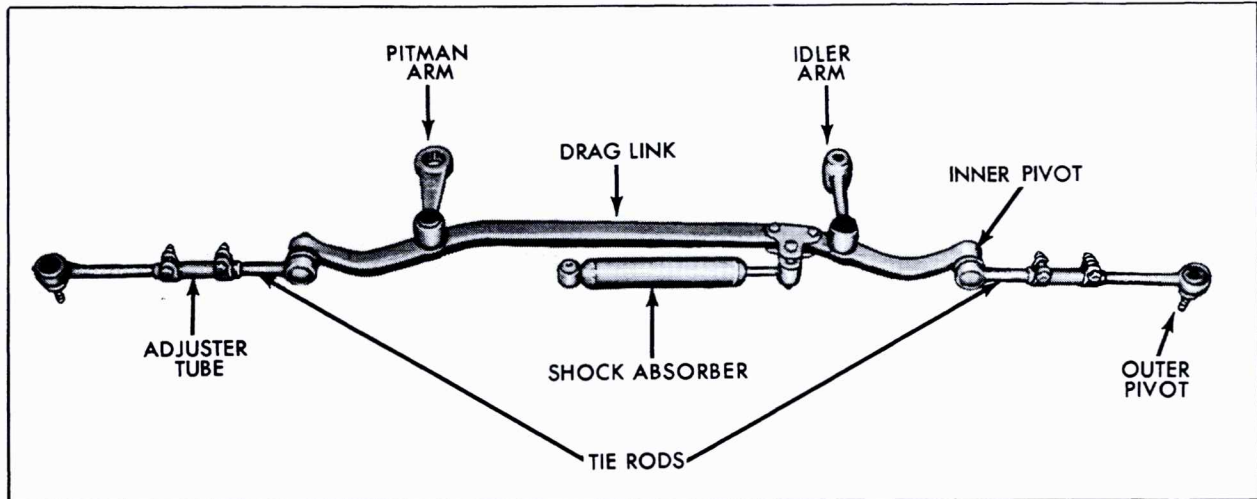


Fig. 9-57 693 - Steering Linkage

b. Installation

1. Position universal joint on lower shaft with flat of shaft in line with split in joint. Secure with screw, tightening it to 80 foot-pounds.
2. Position flexible coupling on steering gear with large pin on coupling at top.
3. Install shaft assembly on car with universal joint engaging steering column shaft. Align split in universal joint with flat on steering column shaft.
4. Engage flexible coupling with flange on shaft and install two bolts that hold coupling together. Tighten bolts to 18 foot-pounds.
5. Position flexible coupling on stub shaft. There should be at least .040 inch clearance between coupling and adjuster plug. Tighten screw to 30 foot-pounds.
6. Secure universal joint to steering column with one screw. Tighten screw to 80 foot-pounds.

27. Steering Column Lower Bearing (693)**a. Removal**

1. Raise car.
2. Remove lower steering shaft as described in Note 26a, steps 1 through 5.
3. Remove lower bearing retaining spring clip by prying clip off shaft and discard clip.
4. Slide nylon bushing off end of shaft.
5. Remove lower bearing adapter retaining ring and reinforcement collar.
6. Remove lower bearing assembly with adapter.
7. Pry bearing assembly out of adapter and discard bearing.

b. Installation

1. Install new lower bearing into bearing adapter.

CAUTION: Make certain that bearing is properly seated in adapter.

2. Install bearing and adapter on shaft. Slide bearing and adapter assembly up into steering column lower jacket.
3. Install reinforcing collar over lower jacket.
4. Install a new reinforcement collar and bearing adapter retaining ring.
5. Install nylon bushing on end of shaft.
6. Install new spring clip on end of shaft.
7. Install lower steering shaft as described in Note 26b.
8. Lower car.

28. Steering Linkage Removal, Disassembly, Assembly, and Installation (693)**a. Removal**

1. Remove front wheels.

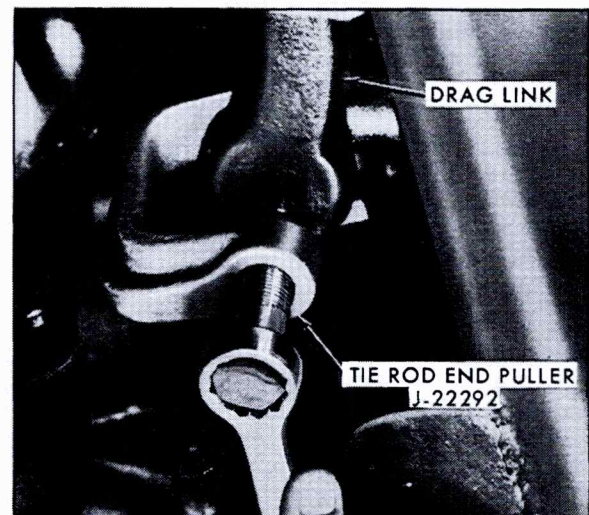


Fig. 9-58 Disconnecting Pitman Arm

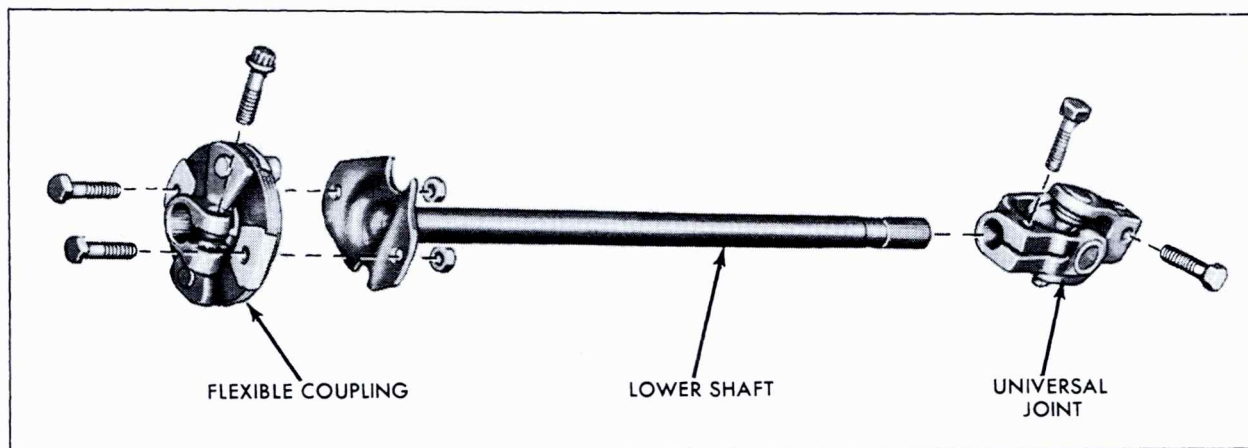


Fig. 9-59 693 - Lower Steering Shaft

2. Remove bolt securing shock absorber to bracket on frame.

3. Remove cotter pins and nuts from pitman arm and idler arm pivots on drag link.

4. Remove idler and pitman arm pivots from drag link using Puller, J-22292, Fig. 9-58.

NOTE: It may be necessary to loosen steering gear at frame to remove drag link from pitman arm.

5. Remove cotter pins and nuts from outer tie rod pivots at steering arms.

6. Remove tie rod pivots from steering arms using Tie Rod End Puller, J-21930.

7. Remove linkage from car.

8. Remove bolt and lock nut securing idler arm to frame and remove idler arm from car.

b. Disassembly

1. Remove cotter pins and nuts from inner tie rod pivots.

2. Remove tie rods using Tie Rod End Puller, J-21930.

3. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing pivots from adjuster tube.

4. Loosen nuts on inner clamp bolts and unscrew tie rod inner pivots from adjuster tubes.

5. Remove bolts securing shock absorber to brackets on drag link and remove shock absorber and spacer.

c. Assembly

1. Position shock absorber and spacer to brackets on drag link. Spacer should be positioned between shock absorber attachment and upper part of bracket.

2. Attach shock absorber to bracket with bolt and tighten all bracket bolts to 15 foot-pounds.

3. Lubricate adjuster tube with chassis lubricant, install adjuster tubes and clamps on tie rod inner pivots.

4. Thread tie rod outer pivots into adjuster tubes.

NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.

5. Install both tie rods on drag link, tighten nuts to 50 foot-pounds and install cotter pins.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

d. Installation

1. Install idler arm on frame with bolt and lock nut. Tighten bolt to 95 foot-pounds.

2. Install drag link on pitman arm and idler arm pivots and tighten pivot nuts to 40 foot-pounds. Install cotter pins.

3. Install outer tie rod pivots to steering knuckles and tighten nuts to 40 foot-pounds. Install cotter pins.

4. Install shock absorber to frame bracket, tighten bolt to 40 foot-pounds.

5. Install front wheels on car.

6. Adjust alignment as described in Section 3, Note 33.

29. Steering Linkage Parallelism (693)

1. Set front standing heights to 8.25" left and right.

2. Measure steering linkage to lower control arm frame attachment distance, left and right. These dimensions should be equal.

3. Loosen the steering gear mounting bolts. Rotate the gear on the bolts to equalize the measurements of step 2. If not sufficient continue to steps 4 and 5.

4. If right side of drag link is high, remove the oil filter, saving the filter and the oil. Push the top of the idler arm frame bracket rearward until drag link measurements in step 2 are equal. Reinstall oil filter and oil.

5. If left side of drag link is high, bend the top of the idler arm frame bracket forward until the measurements in step 2 are equal.

6. Adjust front wheel toe to zero left and right. Center steering wheel with the tie rod adjusters.

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot-Pounds
280M	Mounting Bracket to Pump Screw	3/8 - 16	23
Special	Pump Pressure Unions	5/8 - 18	25
286M	Pump Pulley Nut	1/2 - 20	45
260M	Pump Mounting Bracket to Engine Screw	3/8 - 16	23
260M	Flexible Coupling Upper Clamp Screw	3/8 - 24	30
280M	Flexible Coupling Lower Clamp Screw	3/8 - 24	30
286M	Flexible Coupling Nut (693)	5/16 - 24	18
286M	Flexible Coupling Nut (693)	3/8 - 24	18
300M	Universal Joint Clamp Bolt (693)	7/16 - 20	80
Special	Rack-Piston End Plug	1-5/16 - 16	75
Special	Rack-Piston Ball Guide Clamp Screw	1/4 - 20	12
280M	Steering Gear Side Cover Screws	3/8 - 16	35
300M	Steering Gear to Frame Bolt	7/16 - 14	60
Special	Steering Gear Adjuster Lock Nut	7/16 - 20	30
Special	Pitman Shaft Nut	7/8 - 14	140
Special	Pitman Arm to Drag Link Nut	1/2 - 20	40
Special	Idler Arm to Drag Link Nut	1/2 - 20	40
Special	Inner Tie Rod Pivot to Drag Link Nut	1/2 - 20	50
280M	Idler Arm to Frame Bolt	3/8 - 24	35
Special	Tie Rod Adjuster Clamp Nut	3/8 - 24	20
Special	Tie Rod Pivot to Steering Arm Nut (Except 693)	1/2 - 20	35
Special	Tie Rod Pivot to Steering Arm Nut (693)	1/2 - 20	50
Special	Upper Mounting Bracket to Steering Column Screw	5/16 - 18	20
Special	Lower Mounting Bracket to Steering Column Screw	5/16 - 18	20
Special	Lower Mounting Bracket to Cowl Clamp Screw	5/16 - 18	20
301M	Steering Wheel Nut (Standard Wheel)	9/16 - 18	20
286M	Steering Wheel Nut (Tilt and Telescope Wheel)	9/16 - 18	20
280M	Idler Arm to Frame Bolt (693)	5/8 - 11	95
280M	Shock Absorber to Frame or Bracket Bolts (693)	7/16 - 14	40
300M	Shock Absorber Bracket to Drag Link Bolt (693)	5/16 - 18	15
301M	Shock Absorber Bracket to Drag Link Nut	5/16 - 18	15
	Upper Mounting Bracket to Dash Support Attaching Nut	5/16 - 18	25
280M	Lower Shift Lever to Column Screw	3/8 - 24	25
			Inch-Pounds
6010M	Turn Signal Lever Screw	#8-32	30
1010-	Hazard Warning Knob Screw	#6-32	8
1020	Tilt and Telescope Support Screws	#12-28	50
Special	Ignition Switch to Jacket		25
NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and classification.			

SPECIAL TOOLS

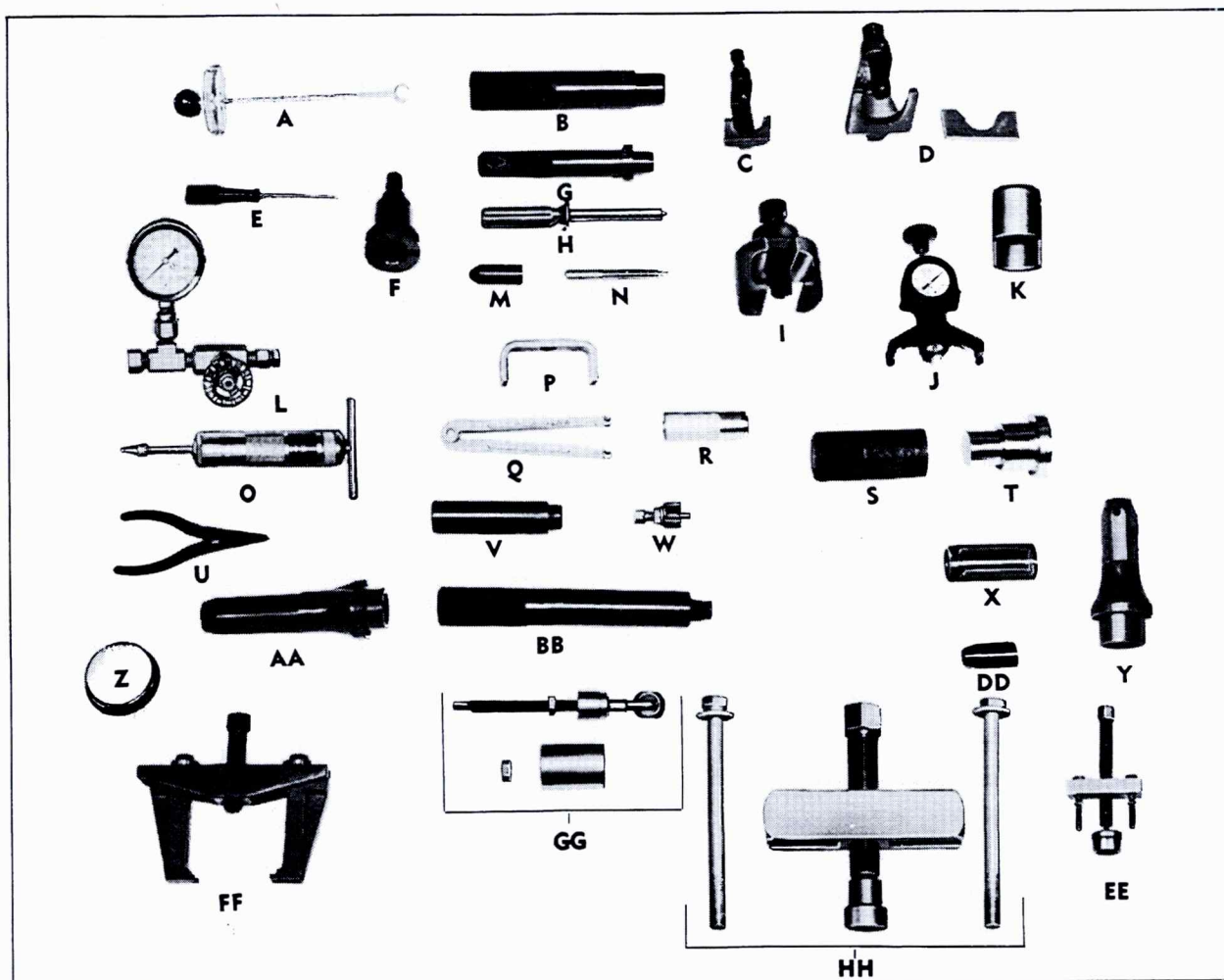


Fig. 9-60 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-7754	Torque Wrench (0-25 inch pounds)	S	J-6219	Pitman Shaft Seal Installer
B	J-6657	Pitman Shaft Bearing Remover	T	J-22407	Pitman Shaft Bearing Installer
C	J-21930	Tie Rod End Puller	U	J-4245	Snap Ring Pliers
D	J-22292	Tie Rod End Puller	V	J-6221	Adjuster Plug Bearing Remover and Installer
E*	J-22635	Pin Remover	W*	J-21854-01	Hardened Step Screw and Pivot Pin Adapter
F	J-21883	Pump Pulley Puller	X	J-7728	Pump Shaft Oil Seal Installer
G	J-5188	Adjuster Plug Seal Installer	Y	J-21150	Seal Installer
H	J-21552	Rack-Piston Arbor	Z	J-7576	Rack-Piston Seal Protector
I	J-9172	Pitman Arm Puller	AA	J-22572	Bearing Installer
J	J-7316	Belt Tension Gage	BB	J-8092	Universal Handle
K*	J-22191	Carrier and Spring Compressor	DD	J-6222	Adjuster Plug Seal Protector
L	J-5176-01	Pressure Testing Gage Assembly	EE*	J-23072	Shift Tube Remover
M	J-22616	Pump Shaft Oil Seal Protector	FF	J-8990	Steering Linkage Puller
N	J-6217	Valve Connector Seat Installer	GG*	J-23073	Shift Tube Installer
O	J-9280	Packing Gun	HH	J-1859-03	Steering Wheel Puller
P	J-23131	Carrier and Spring Compressor			
Q	J-7624	Spanner Wrench			
R	J-22569	Snap Ring Remover			

*Denotes Tilt and Telescope column only.

GENERAL DESCRIPTION

Wheels

The wheels used on all 1969 Cadillac cars have a drop center rim design. They are secured to the hub by five right hand threaded nuts. Valve stem replacements, installation torques and wheel descriptions are given in the WHEEL, VALVE AND FASTENING TABLE, Fig. 10-8.

Tires

The original equipment tires installed on all 1969 Cadillac cars are selected to provide the best all around tire performance for normal operation. They are designed to operate satisfactorily with loads up to and including the specified full rated load capacity of the car when inflated as recommended in the TIRE USAGE AND INFLATION PRESSURE TABLE, Fig. 10-9.

SERVICE INFORMATION

1. Tire Rotation

To equalize tire wear, it is recommended that tires be rotated every 6,000 miles on all 1969 Cadillacs. On the front wheel drive Fleetwood Eldorado, it is essential that tires be rotated at intervals not to exceed 6,000 miles.

Tire rotation on the Fleetwood Eldorado may be required more frequently if the car is driven under extreme operating conditions, such as those listed below.

1. High speed cornering.
2. Severe cornering.
3. Rapid acceleration, causing slippage of the driving wheels.
4. Unusually abrasive road surfaces.

A suggested rotation interval when the Fleetwood Eldorado is operated under these extreme operating conditions is every 4,000 miles.

Tires should be rotated according to the pattern shown in Fig. 10-1. Inspect tires and tire pressures prior to rotating, and adjust tire pressures (front and rear) after rotation in accordance with recommendations in the Tire Usage And Inflation Pressure Table.

2. Tire Inspection

A decrease in traction, anti-skid properties and road hazard resistance occurs as tires become worn. The original equipment tires used on all 1969 Cadillacs incorporate built-in tread wear indicators to assist the owner in judging when tires should be replaced. These indicators

are molded into the bottom of the tread grooves and will appear as 1/2 inch wide bands when tire tread depth becomes 1/16 of an inch, Fig. 10-2.

Tire inspection consists of observation for, and correction of, the following:

1. Abnormal wear.
2. Bulges or other irregularities.
3. Objects puncturing tire.
4. Tread cracks or cuts.
5. Sidewall cracks, cuts or scuffs.
6. Unusually low inflation pressures, indicating possible leakage.
7. Missing valve caps or damaged valve stems.
8. Loose, missing or defective wheel fastening.
9. Damaged or defective wheels.
10. Improper tire size or rating.

3. Tire Wear

Improper inflation pressures will cause abnormal wear conditions like those shown in Fig. 10-3.

a. Underinflation Wear

Underinflation results in abnormal wear of the tread shoulder, caused by the tires rolling on the shoulders with a wiping action.

In addition, underinflated tires are subjected to

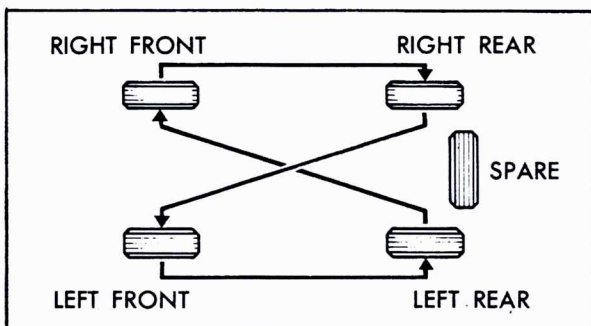


Fig. 10-1 Tire Rotation

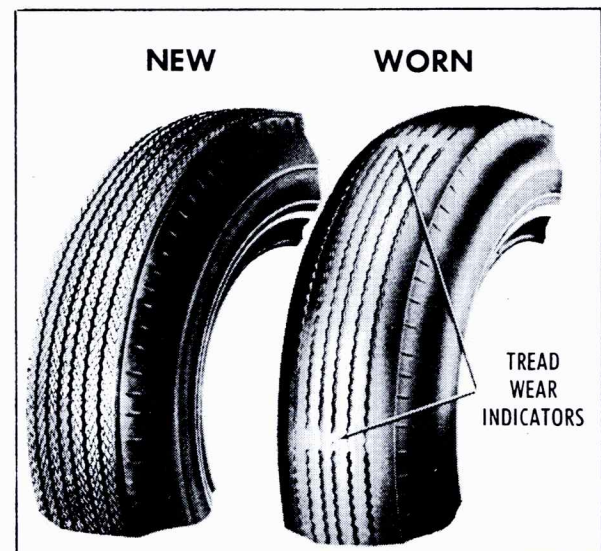


Fig. 10-2 Tread Wear Indicators

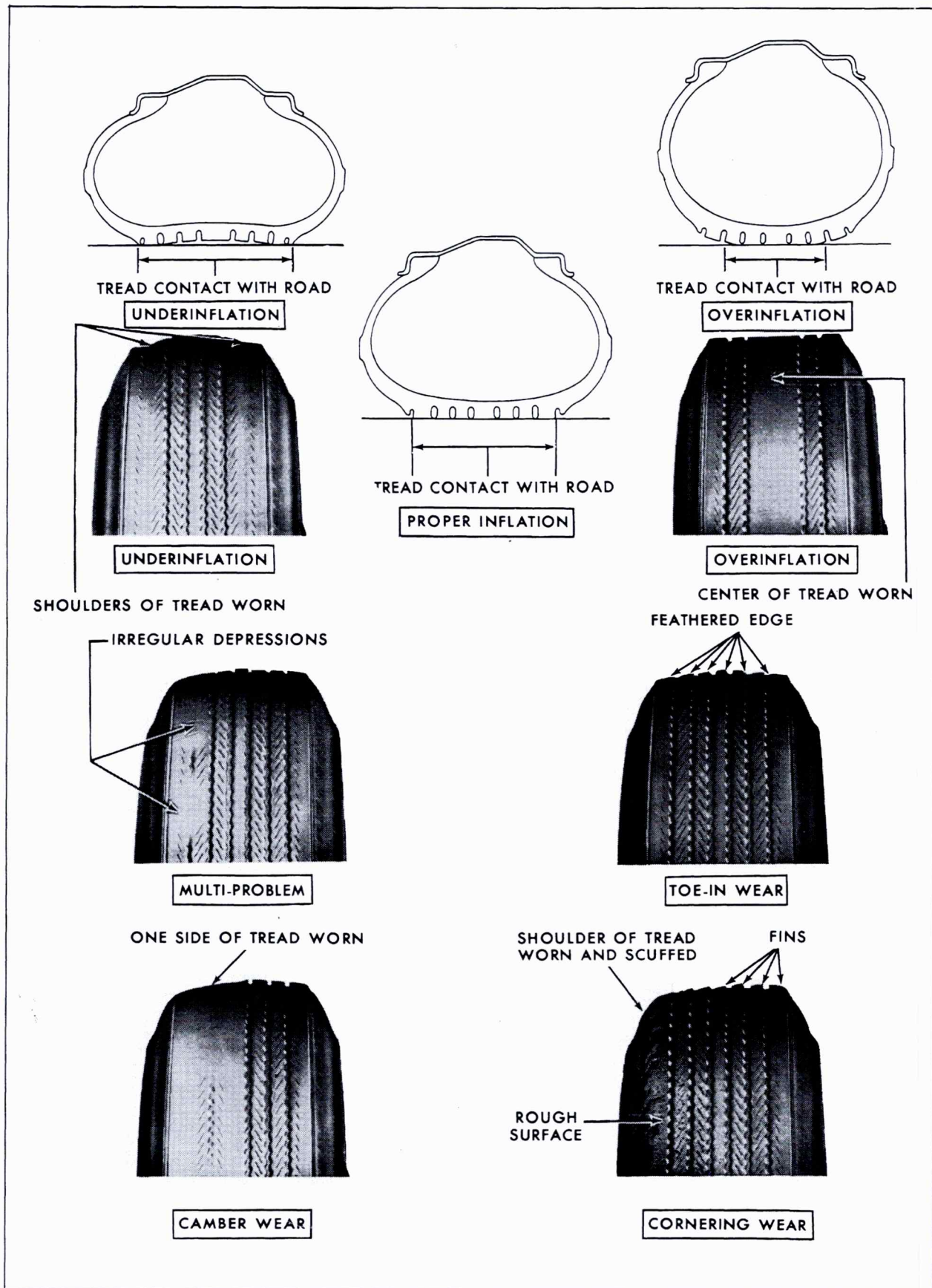


Fig. 10-3 Tire Wear Patterns

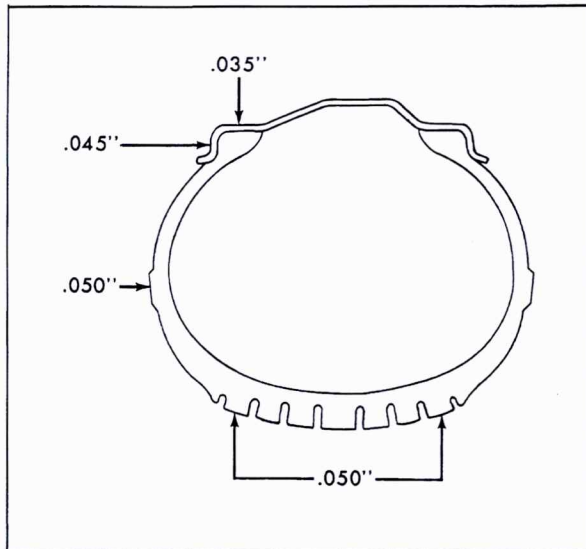


Fig. 10-4 Wheel and Tire Specification

excessive flexing, causing high internal temperatures and cracking of the sidewall.

b. Overinflation Wear

Overinflation causes the center section of the tread to receive excessive driving and braking loads, so that the center section is worn more than the shoulders. An overinflated tire is subject to breaks in the fabric from severe impacts and is more easily cut or punctured.

c. Toe-in or Toe-out Wear

Excessive toe-in or toe-out has the effect of dragging the tires sideways down the road, which results in feathering the raised portions of the tread.

Improper toe-in is indicated by feather edges

on the inner side of the tread. Toe-out is indicated by the feather edges on the outer side of the tread.

d. Camber Wear

Excessive positive camber will cause wear on the outer side of the tread. Excessive negative camber will cause wear on the inner side of the tread. Camber wear may also be evident if the car is driven continually on highly crowned roads.

e. Wear Due to Mechanical Conditions

Loose parts of the front suspension system, such as worn spherical joints, mountings of the upper and lower control arms, inoperative shock absorbers and unbalanced wheels and tires, will cause flat spots, cups, gouges and wavy wear.

4. Tire Roughness or Noise

Rolling smoothness or performance is dependent on several factors. Servicing procedures recommended here are in their order of involvement, and can be checked in the sequence outlined below:

a. Runout

Check inflation pressures and perform the tire inspection including removal of any foreign material on tire tread or wheel large enough to upset balance.

Look for excessive runout (wobble) or irregularities when spinning the wheel. Runout limits are indicated in Fig. 10-4.

When measuring lateral runout at sidewall and wheel flange, use Dial Indicator, J-8001. Provide a stand similar to the one shown in Fig. 10-5. This stand was made with Dial Indicator Support, J-6126, and part of Clutch Piston Actuator Set, J-4353.

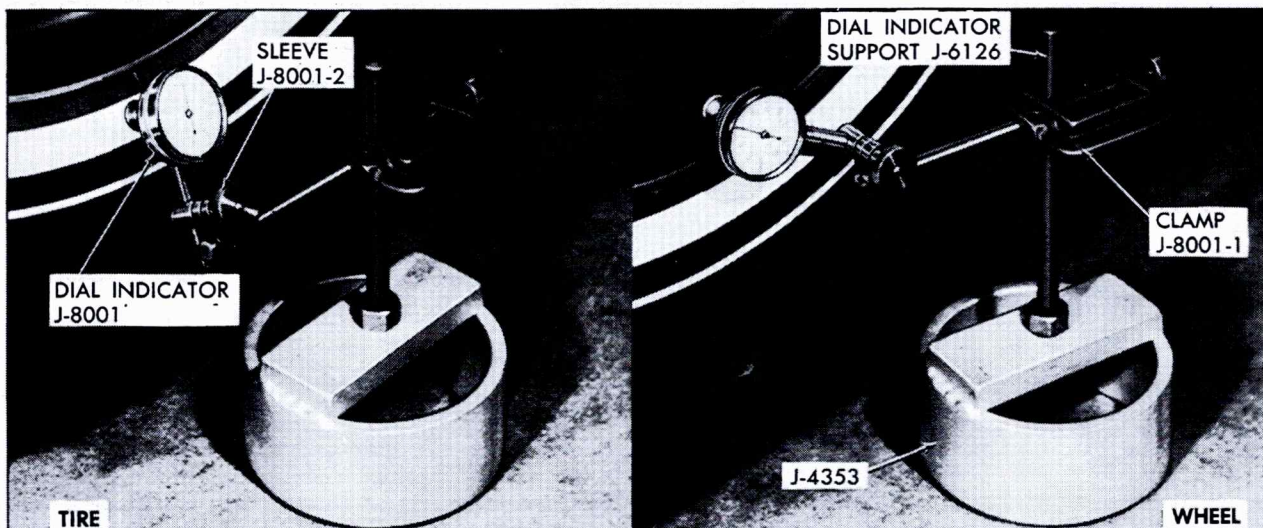


Fig. 10-5 Checking Lateral Runout

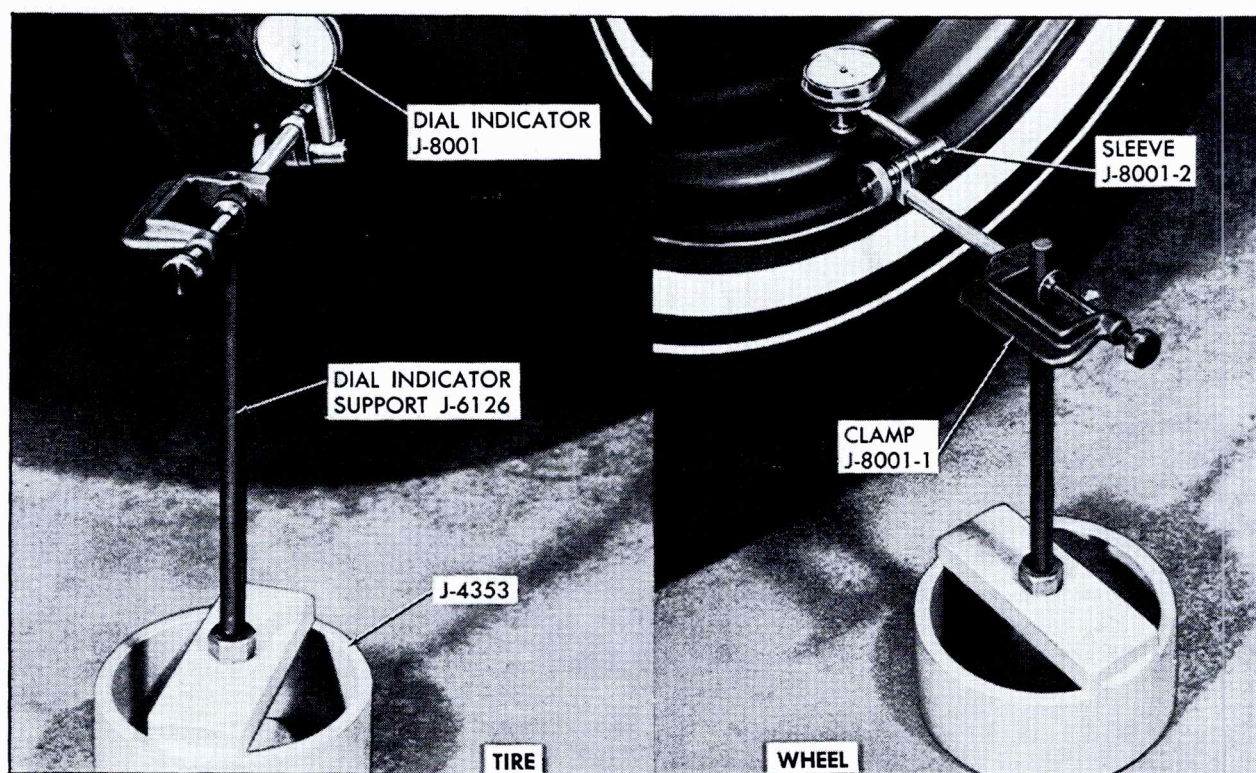


Fig. 10-6 Checking Radial Runout

When checking radial runout at tire outer tread and wheel flange, position dial indicator as shown in Fig. 10-6.

Replacement of a questionable wheel and tire assembly with a unit known to be good may serve as a faster way of determining the source of disturbance.

b. Balancing

NOTE: (All cars except 693)

If wheels will not spin at balancing speeds, raise car and push caliper housing outboard toward side of car to free disc from linings.

CAUTION: After balancing wheels and before driving car, make sure a firm brake pedal is obtained.

Static balancing corrects for unequal weight distribution about the axis of rotation, Fig. 10-7.

Dynamic balancing of the wheel and tire assembly corrects for static unbalance as well as unbalance which tends to "turn" the wheel, causing side disturbances as shown in Fig. 10-7.

Dynamic balancing on the car corrects for brake drum unbalance as well as the wheel and tire assembly conditions. Dynamic balancing on the car is required after tires are rotated.

Diagnosis and correction of static and dynamic unbalance conditions are performed on equipment that is available commercially. In every case, follow the instructions and recommendations of the equipment manufacturer to assure accurate workmanship.

CAUTION: On-car type wheel balancers are not generally recommended for use on the rear wheels of cars equipped with the optional Controlled Differential.

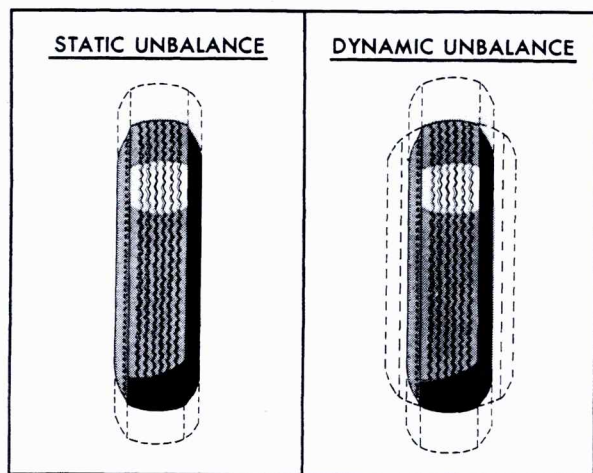


Fig. 10-7 Static and Dynamic Unbalance

c. Road Testing

If runout checking and balancing do not correct the condition, road testing is recommended as follows:

Inflate the tires to 32 psi. inflation pressure. Ride the car, reducing one tire at a time to the prescribed inflation pressure. Disturbing wheel

and tire assemblies indicated by an increase in roughness after they are deflated may be corrected by indexing the tire on the wheel to a position which minimizes radial or lateral runout, whichever exceed specifications.

5. Tire Mounting and Demounting

The following precautions should be observed during tire mounting on or demounting from the wheel rim:

1. Start with the narrow ledge of the rim up, regardless of which side of wheel the narrow ledge is on.

NOTE: Special adapters may be required with certain equipment for mounting or demounting tires on the Fleetwood Eldorado.

2. Clean the rim in the ledge and flange areas and coat both areas thoroughly with an approved rubber lubricant prior to mounting.

3. Use of one of several devices which are available to assist in bead unseating or seating will be helpful; however, sharp objects or forcing of the bead may cause tire damage.

CAUTION: When mounting tires, lock the wheel down and do not stand over the tire while inflating. Do not exceed 40 psi inflation pressure, when seating tire on the wheel.

DIAGNOSIS CHART




CONDITION	CAUSE	CORRECTION
Front wheel roughness.	Wheels and tires out of balance. Wheels or tires out of round. Steering gear or steering connections incorrectly adjusted or worn. Worn spherical joints. Damaged spherical joint seals. Front wheel bearings incorrectly adjusted or worn. Shock absorbers inoperative.	See Note 4 of this section. Check and adjust to specification. Replace lower joints and/or upper arm as assembly. Replace and repack seals. Adjust or replace if necessary. Check and replace if necessary.
Hard riding.	Excessive friction in front suspension. Tires overinflated. Shock absorbers. Springs with incorrect rating being used.	Check spherical joint seals for damage. If necessary replace seals and repack joints. Correct tire pressure. Check and replace if necessary. Install springs with correct rating.

WHEEL, VALVE AND FASTENING TABLE

Wheel, Valve and Fastening Table	Calais, Deville, Fleetwood Sixty Special and Brougham	Fleetwood Seventy Five Commercial Vehicle	Fleetwood Eldorado
Wheel Size and Flange Type	15x6JK	15x6JK	15x6JK
Spider to Rim Attachment	Spot Welded	Riveted	Riveted
Offset (Rim Center Line to Mounting Surface)	.29 In.	.29 In.	3.25 In.
Wheel Color	Black	Gray	Black
Valve Stem	T.R. 413	T.R. 413	T.R. 417
(Number of Fasteners), Bolt Circle	(5), 5.0 In.	(5), 5.0 In.	(5), 5.0 In.
Fastener Torque	90 to 120 ft. lbs.	90 to 120 ft. lbs.	90 to 120 ft. lbs.

Fig. 10-8 Wheel, Valve and Fastening Table

TIRE USAGE AND INFLATION PRESSURE TABLE—Pounds per square inch (cool)

 Calais, DeVille, Fleetwood Sixty Special & Brougham	9.00-15 (Load Range B)	STANDARD INFLATION PRESSURES	For all loads, including full rated load, 6 passengers plus 200 lb. trunk load (1100 lb. total)	FRONT REAR 24 26 p.s.i.
		OPTIONAL INFLATION PRESSURES	For reduced loads 1 to 5 passengers (750 lb. total)	FRONT REAR 24 24 p.s.i.
 Fleetwood Eldorado	8.85-15 9.00-15 or J78-15 (Load Range B)	STANDARD INFLATION PRESSURES	For all loads, including full rated load, 6 passengers plus 200 lb. trunk load (1100 lb. total)	FRONT REAR 26 20 p.s.i.
		OPTIONAL INFLATION PRESSURES	For reduced loads 1 to 5 passengers (750 lb. total)	FRONT REAR 28 36 p.s.i.
 Fleetwood Seventy-Five	8.20-15 (Load Range D)	STANDARD INFLATION PRESSURES	For all loads, including full rated load, 9 passengers plus 200 lb. trunk load (1550 lb. total)	FRONT REAR 28 36 p.s.i.
		OPTIONAL INFLATION PRESSURES	For reduced loads 1 to 5 passengers (750 lb. total)	FRONT REAR 28 28 p.s.i.

- Tire inflation pressures may increase as much as 6 pounds per square inch (p.s.i.) when tires are hot.
- For continuous high speed operation (over 75 mph) increase tire inflation pressures 4 pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch—cool for Load Range B tires or 40 pounds per square inch—cool for Load Range D tires. When the 4 p.s.i. pressure adjustment for sustained high speed with maximum vehicle load would require inflation pressures above the maximum allowable, speed must be limited to 75 m.p.h.
- Cool tire inflation pressure: after vehicle has been inoperative for 3 hours or more, or driven less than 1 mile. Hot tire inflation pressure: after vehicle has been driven 10 miles or more at 60-70 miles per hour.
- Vehicles with luggage racks do not have a vehicle load limit greater than specified in the tire inflation pressure table.
- When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.
- Full rated load for vehicles having bucket seat option; 5 passengers plus 200 lb. trunk load (950 lb. load).

Fig. 10-9 Tire Usage and Inflation Pressure Table

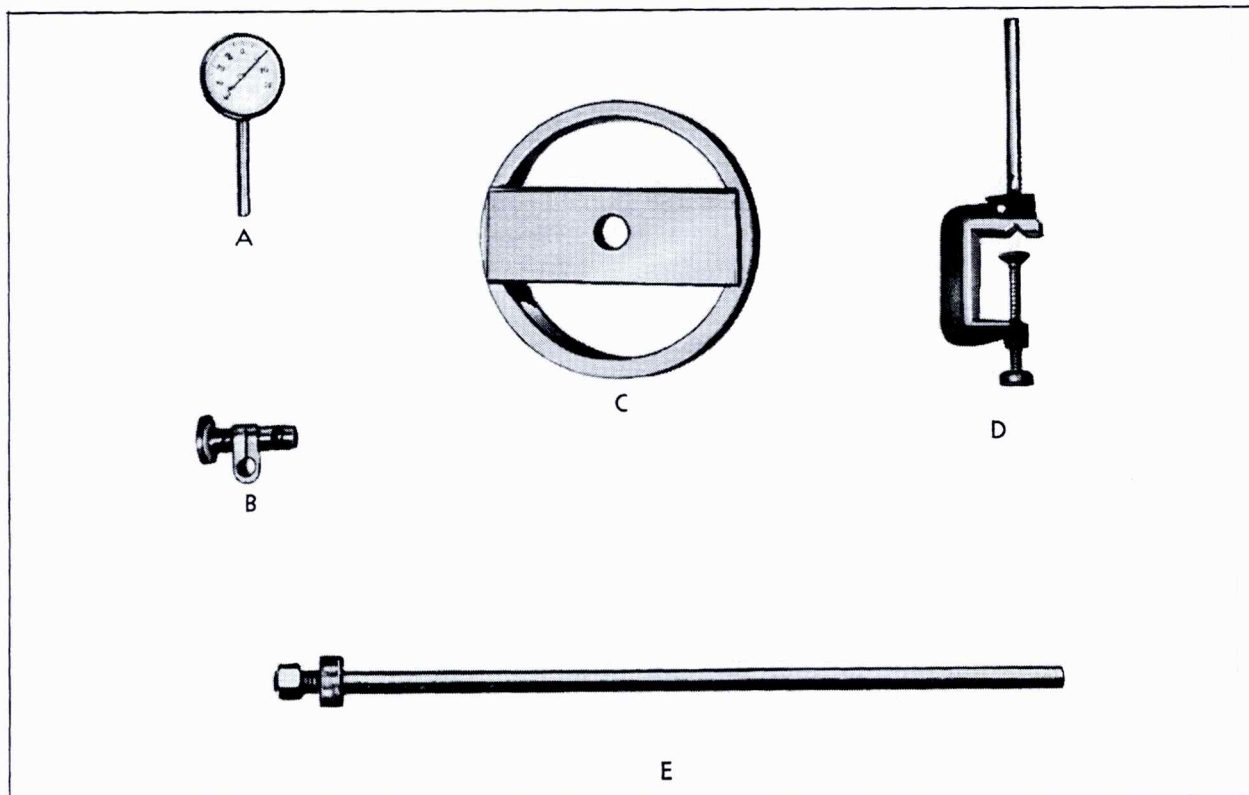


Fig. 10-10 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8001-3	Dial Indicator	D	J-8001-1	Clamp
B	J-8001-2	Sleeve	E	J-6126	Dial Indicator Support
C	J-4353	Dial Indicator Support Base			

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado chassis sheet metal, refer to the latter portion of this section.

The 1969 Cadillac sheet metal described in this section consists of the following items: hood, front fenders, and wheel housings.

The hood is hinged near the cowl and opens from the front. Dual hood latches are located on the right and left ends of the hood inner panel and

are linked together with a tie bar. The hood is opened by pushing upward on the hood release lever that is accessible between the grille and hood panel, just to the right of the hood centerline as you face the vehicle. The lever first releases the pilot latches and then the secondary latch, permitting the hood to be raised.

The front fender assemblies provide mounting attachments that incorporate the parking, turn signal, cornering and marker lamp assembly.

SERVICE INFORMATION

1. Hood Latch Mechanism Adjustment

The hood latch assembly is attached to the hood inner panel by eight screws, Fig. 11-1, three at each latch and two at the center support bracket. The hood latch pilots, Fig. 11-2, are each attached to the tie bar by one nut and washer on the underside of the tie bar and a washer and jam locknut on top of the tie bar.

The pilots may be adjusted vertically by loosening the jam locknut, rotating the pilots up or down as required, and then tightening the jam locknut. Enlarged holes in the hood latch pilot tie bar provide for side-to-side and fore-and-aft adjustment of the hood latch pilots.

When the hood latch assembly or the hood latch pilots have been removed, the mounting screws loosened, or the hood adjustment changed, make certain that the proper alignment has been obtained before tightening the pilot jam locknut. Failure to do so may result in damage to the latching assembly due to misalignment when the hood is closed.

2. Hood Panel

a. Removal (Fig. 11-3)

1. Scribe hinge locations on underside of hood panel to aid in repositioning the hood when it is re-installed.

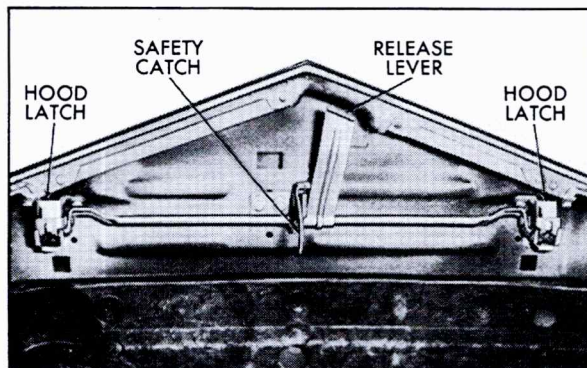


Fig. 11-1 Hood Latch Assembly

2. Remove six screws and washers, three each side, retaining hinge assemblies to hood panel.

3. Remove hood with the aid of a helper, using care to avoid damaging finish.

CAUTION: When hood is removed from car, never stand it upright on rear corners nose up. Hood must be positioned so that it rests on its side; otherwise, damage to sheet metal may result.

b. Installation (Fig. 11-3)

NOTE: Install an exhaust manifold stud in center holes of hood retaining plate to help locate and position adjusting screws when installing hood.

1. With the aid of a helper, place hood in position on hood hinge assemblies and loosely install three screws and washers at each hinge assembly.

2. Position hood so that hinges line up with scribe marks and tighten screws at each hinge.

3. Carefully close hood and check alignment of hood at fender and grille opening.

4. Align hood, if necessary, as described in Note 3.

5. Adjust hood latch mechanism as described in Note 1.

3. Hood Adjustment

1. Loosen hood attaching screws, three at each hood hinge, Fig. 11-3. Elongated holes in hinge

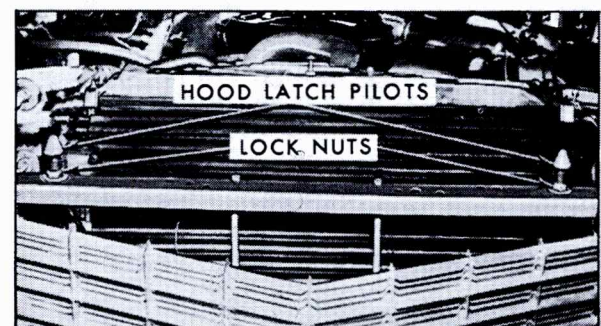


Fig. 11-2 Hood Latch Pilots

provide fore, aft, and side adjustment of hood. Position hood so that tolerances shown in Fig. 11-5 are provided.

2. Tighten hinge to hood attaching screws on both sides.

3. Adjust rubber bumpers, located on the tie bar, two each side, so that hood panel is flush with fenders at this point.

4. Adjust hood latch mechanism as described in Note 1.

4. Hood Hinge Spring

a. Removal (Fig. 11-3)

1. Open hood and prop as high as possible.

2. Using a strong wire hook, attach one end to center of pry bar of sufficient length and the other end to hinge spring.

3. With the aid of a helper, lift pry bar until spring disengages from hood hinge, then release pressure on bar slowly until spring is loose, then unhook other end of spring from hinge.

b. Installation (Fig. 11-3)

1. Hook one end of spring on hinge, then with the aid of a helper, use pry bar and wire hook to connect spring to front of hinge.

5. Front Fender (Right or Left) Removal and Installation

a. Removal (Fig. 11-4)

1. If left fender is to be removed, disconnect negative battery cable. If right front fender is to be removed, remove the battery and the antenna

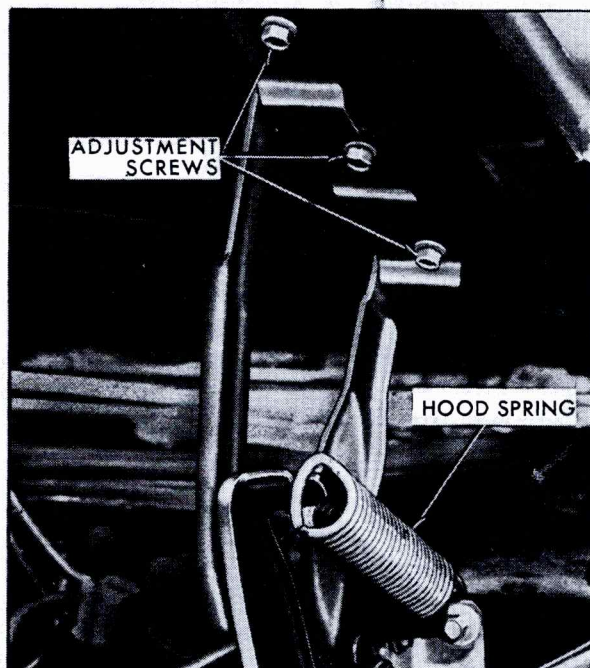


Fig. 11-3 Hood Hinge

as described in Section 15, Note 12a. Note number of shims at each attaching, so that same number are installed during installation.

2. Apply masking tape to rear edge of fender to avoid scratching finish when removing fender.

3. Raise front end of car and remove wheel on side of car that fender is being removed.

4. Remove one screw with washer attached, shims and tapping plate, retaining fender to door hinge pillar.

5. Remove two screws with washers attached and shims that hold rear bottom of fender to rocker panel.

6. Remove six fender attaching screws with washers attached from wheel opening edge of wheel housing.

7. Remove two screws with washers attached from inside top of wheel housing.

8. Remove one screw with washer attached from angle bracket that secures radiator cradle to fender.

9. Remove one screw with washer attached and tapping plate from angle bracket that secures fender to radiator cradle.

10. Remove one screw with washer attached that secures filler to fender at back end of filler.

11. Disconnect cornering light and position the wiring harness out of the way.

12. Remove three screws with washers attached that secure cornering light to fender and remove light.

13. Remove screw with washer attached under radiator cradle tie bar that secures tie bar to fender in headlight area.

14. Remove one screw with washer attached and shims that hold fender to cowl.

15. Remove one screw with washer attached, shims and tapping plate that controls poise of front end of fender.

16. Remove fender by lifting outward and slightly forward.

b. Installation (Fig. 11-4)

All fender attaching bolts should be loosely installed until fender alignment is obtained. Install the same number of shims at each location as were removed. Then tighten to proper torque specification. Loosen wheel housing attaching screws if necessary to align fender properly.

1. Position fender in approximate location, being careful not to damage leading edge of door or trailing edge of fender. Be sure that rubber seal at front of fender below cornering light is properly positioned.

2. Install one screw with washer attached and shims at top rear of fender.

3. Install two screws with washers attached to wheel housing at top of wheel opening.

4. Install five screws at wheel opening edge of fender, securing fender to wheel housing.

5. Install two screws with washers attached and shims that hold rear bottom of fender to rocker panel.

6. Install one screw with washer attached and

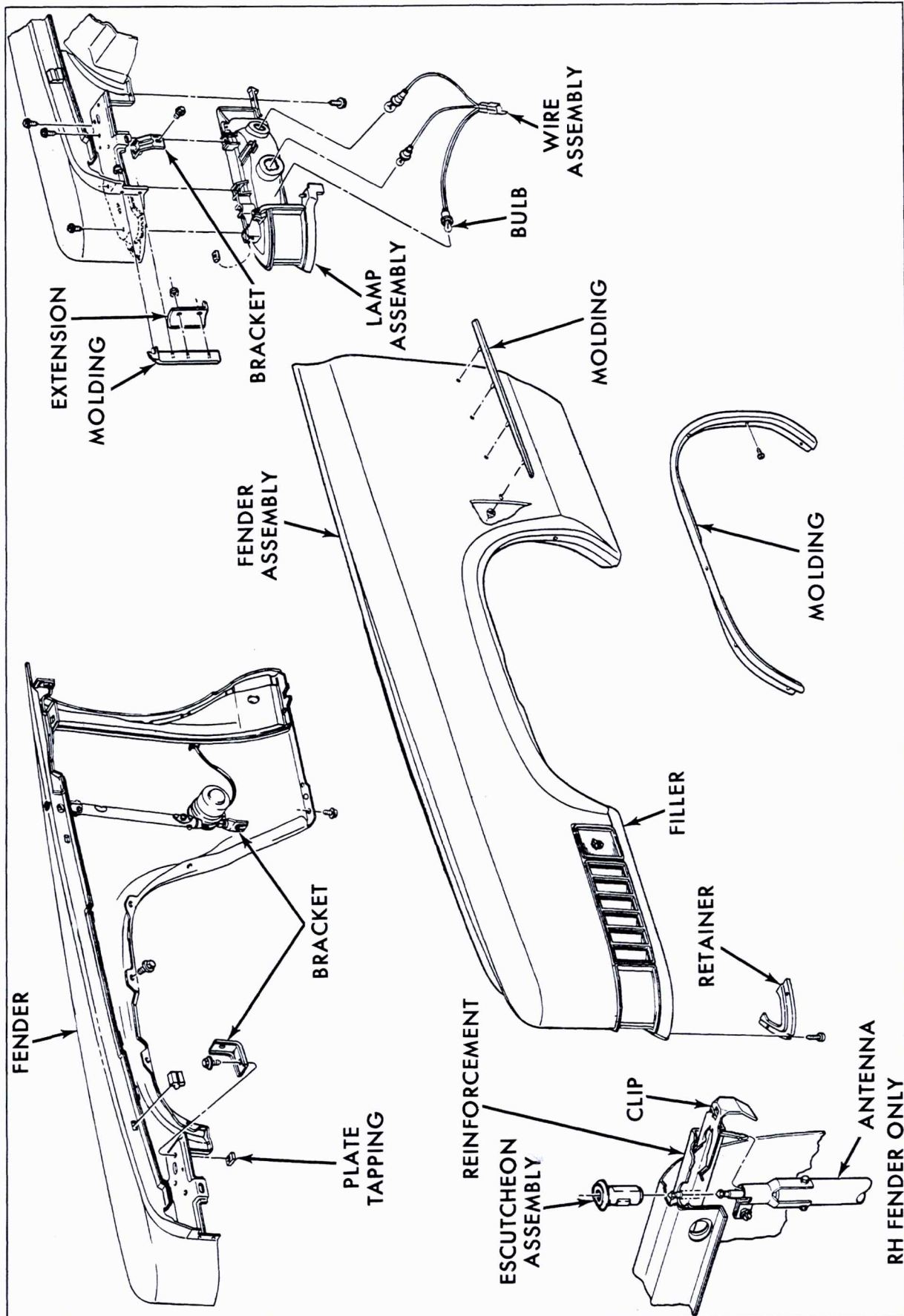


Fig. 11-4 Front Fender Disassembled

shims that hold fender to cowl.

7. Install one screw with washer attached into angle bracket that secures radiator cradle to fender.

8. Install one screw with washer attached and tapping plate from angle bracket that secures fender to radiator cradle.

9. Install three screws with washers attached securing radiator cradle and cornering light.

10. Install screw under radiator cradle tie bar to secure tie bar to fender in headlight area.

11. Install three screws with washers attached that secure cornering light to fender.

12. Install one screw with washer attached that secures filler to fender at back end of filler.

13. Install one screw with washer attached, shims and tapping plate that controls poise of front end of fender.

14. Position wiring harness and connect cornering light.

15. Obtain proper alignment of fender as shown in Fig. 11-5, and tighten all screws installed in steps 2 through 9 to proper torque as shown in chart on page 11-6.

16. Install or connect battery as required.

17. Install antenna as described in Section 15, Note 12b, if right front fender was removed.

18. Install wheel and lower car to floor.

6. Front Fender Wheel Housing (Right or Left) Removal and Installation

a. Removal

1. Remove front fender as described in Note 5a.

2. Disconnect underhood wiring harness from retainer clips on wheel housing.

3. When removing right wheel housing, proceed as follows:

a. Disconnect multiple connector at voltage regulator and remove screw securing ground wire.

b. Unsnap hose clamp and remove heater hoses from wheel housing.

c. If car has seat warmer, remove nut, spacer and bolt and remove seat warmer tee.

4. If left wheel housing is being removed, proceed as follows:

a. If car has Cruise Control, remove power unit from left wheel housing as described in Section 15, Note 28a.

b. Remove three screws that hold windshield washer solvent container to wheelhouse and remove container.

c. Remove two screws and wire bracket holding radiator overflow reservoir to front of cradle and remove reservoir.

d. Remove horn from radiator cradle.

5. Remove one snap in fastener, front bumper seal to wheel housing.

6. Remove four screws with washer attached at rear of wheel housing that secures strut to wheel housing.

7. Remove screw and washers from inside of wheel housing, holding rear seal to frame.

8. Remove four screws with washer attached, and tapping plate from angle bracket that secures hood hinge to wheel housing.

9. Remove two nuts and washers from wheel housing strut that secure cowl bar to wheel housing.

10. Remove four screws with washers attached, nuts, washers and tapping plate from angle bracket that secure the front of wheel housing to cradle.

11. Remove two bolts, washer, nuts, tapping plate and stud retainer from strut at front of wheel housing that secure wheel housing to cradle.

12. Remove wheel housing.

b. Installation

1. Position wheel housing in approximate location and loosely install four screws with washer attached at rear of wheel housing that secure strut to wheel housing.

2. Loosely install four screws with washer attached and tapping plate from angle bracket that secure hood hinge to wheel housing.

3. Loosely install four screws attached, nuts, washers and tapping plate from angle bracket that secure the front of wheel housing to cradle.

4. Install two bolts, washer, nuts, tapping plate and stud retainer from strut at front of wheel housing that secure wheel housing to cradle.

5. Loosely install two nuts and washers onto wheel housing strut that secure cowl to wheel housing.

6. Install one snap-in fastener, front bumper seal to wheel housing.

7. If right wheel housing is being installed, proceed as follows:

a. Reconnect multiple connector to voltage regulator and secure ground wire with screw.

b. Position and secure heater hoses to wheel housing.

c. Install bolt, nut and spacer and seat warmer tee.

8. If left wheel housing is being installed, proceed as follows:

a. If vehicle is equipped with Cruise Control, install power unit on wheel housing as described in Section 15, Note 28b.

b. Install three screws to hold windshield washer solvent container to wheelhouse.

c. Install two screws and wire bracket to hold radiator overflow reservoir to front of cradle and install reservoir.

d. Install horn on radiator cradle.

9. Check alignment of wheel housing and tighten all attaching nuts, bolts and screws.

10. Connect underhood wiring harness to retainer clips on wheel housing.

11. Install screw and washer to hold rear seal to frame.

12. Install front fender as described in Note 5b.

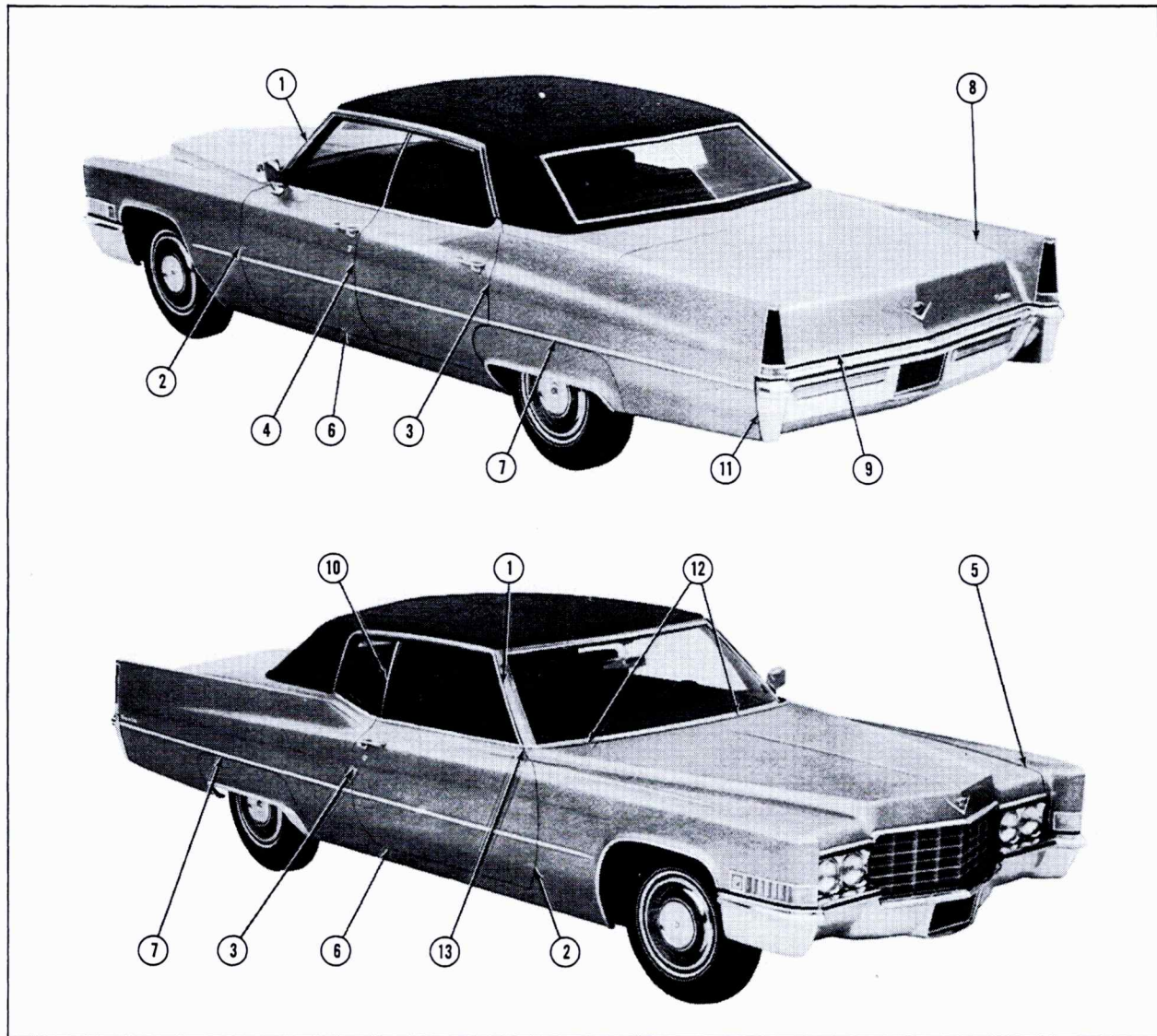


Fig. 11-5 Sheet Metal Tolerances

SHEET METAL TOLERANCES (EXCEPT 693)			
Location	Style	Clearance Gap"	Flushness
1. Side window to windshield	All except 23 and 33	3/8-7/16 1/8-1/4	— —
2. Door to Fender	All	3/16-1/4	3/32 +0.0
3. Door to Quarter Panel	All	1/8-1/4	+0-1/16
4. Front Door to Rear Door	All	1/8-1/4	+0-1/16
5. Hood to Fender	All	3/32-5/32	±1/16
6. Door to Rocker Panel	All	1/8-1/4	—
7. Wheel Skirt to Quarter Panel	All	1/8-1/4	±1/16
8. Trunk Lid to Fender	All	1/16-1/4	±1/16
9. Trunk Lid to Bumper	All	5/16-7/16	—
10. Windows	49, 47 & 67 only	5/16-3/8	*
11. Bumper to Quarter Panel	All	3/8-11/16	—
12. Hood to Windshield Wiper Arm	All	1/8 Min.	—
13. Hood to Door	All	1/8-3/16	±1/16

*May be out of plane if weatherstrip provides watertight seal.

7. Adjusting Sheet Metal Tolerances

a. Front Fender

1. Loosen all screws at the following locations:
 - a. Fender reinforcement to radiator cradle bracket.
 - b. Cowl
 - c. Front hinge pillar
 - d. Rocker panel extension to underside of fender.
 - e. Fender to wheel housing inside of wheel opening.
2. Remove rubber bumpers that fit between fender and hood.

3. Adjust fender so that clearances are as shown at points #2, #5, #12 and #13, Fig. 11-5.

4. After obtaining adjustment, tighten all screws to proper torque specifications as shown at the end of this section.

5. Install rubber bumpers that fit between fender and hood.

b. All Body Clearances

The adjustment procedures for clearances #1 thru #13 in Fig. 11-5 (except #2, #5, #12 and #13) are found in the 1969 Fisher Body Service Manual. These clearances should be adjusted to the specifications shown in Fig. 11-5.

TORQUE SPECIFICATIONS (EXCEPT 693)

Material No.	Application	Size	Foot Pounds
260M	Hood Hinge to Hood	3/8-16	25
260M	Hood Hinge to Cowl	3/8-16	30
260M	Front Fender to Radiator Cradle	3/8-16	25
Special	Front Fender to Cowl	3/8-16	25
Special	Front Fender to Rocker Panel	3/8-16	25
Special	Front Fender to Hinge Pillar	3/8-16	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			

CHASSIS SHEET METAL—FLEETWOOD ELDORADO

GENERAL DESCRIPTION

The 1969 Cadillac Fleetwood Eldorado sheet metal described in this section consists of the following items: hood, front fenders, wheel housings, and fuel tank filler door. Information not contained here will be found in the 1969 Fisher Body Service Manual.

The hood is hinged near the cowl and opens from the front. Dual hood latches are located on the right and left ends of the hood inner panel and are linked together with a tie bar. The hood is

opened by pushing upward on the hood release lever that is accessible between the grille and hood panel, just to the right of the hood centerline as you face the vehicle. The lever first releases the pilot latches and then the secondary latch, permitting the hood to be raised.

The front fender assemblies provide mounting attachments that incorporate the cornering and side marker lamp and the parking and turn signal lamp assemblies.

SERVICE INFORMATION

8. Hood Latch Mechanism Adjustment

The hood latch assembly is attached to the hood inner panel by eight screws, Fig. 11-6, three at each latch and two at the center support bracket. The hood latch pilots, Fig. 11-7, are each attached to the tie bar by one nut plate on the underside of the tie bar and an adjustable locknut on top of the tie bar.

The pilots may be adjusted vertically by loosening the adjustable locknut, rotating the pilots up or down as required, and then tightening the locknut. Enlarged holes in the hood latch pilot tie bar provide for side-to-side and fore-and-aft adjustment of the hood latch pilots.

When the hood latch assembly or the hood latch pilots have been removed, the mounting screws loosened, or the hood adjustment changed, make certain that the proper alignment has been obtained before tightening the pilot locknut. Failure to do so may result in damage to the latching assembly due to misalignment when the hood is closed.

9. Hood Panel

a. Removal (Fig. 11-8)

1. Scribe hinge locations on underside of hood panel to aid in repositioning the hood when it is re-installed.

2. Remove six screws and washers, three each side, retaining hinge assemblies to hood panel.

3. Remove hood with the aid of a helper, using care to avoid damaging finish.

CAUTION: When hood is removed from car, never stand it upright on rear corners nose up. Hood must be positioned so that it rests on its side; otherwise, damage to sheet metal may result.

b. Installation (Fig. 11-8)

NOTE: Install an exhaust manifold stud in center holes of hood retaining plate to help

locate and position adjusting screws when installing hood.

1. With the aid of a helper, place hood in position on hood hinge assemblies and loosely install three screws and washers at each hinge assembly.

2. Position hood so that hinges line up with scribe marks and tighten screws at each hinge.

3. Carefully close hood and check alignment of hood at fender and grille opening.

4. Align hood, if necessary, as described in Note 10.

5. Adjust hood latch mechanism as described in Note 8.

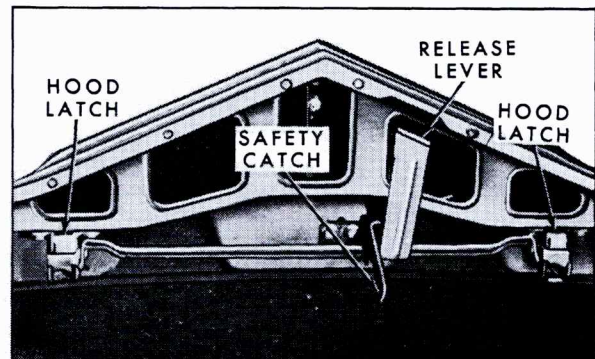


Fig. 11-6 Hood Latch Assembly - 693

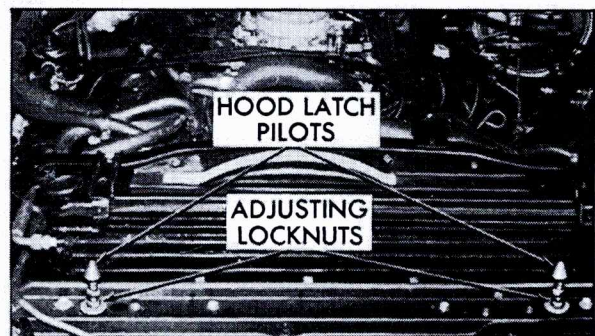


Fig. 11-7 Hood Latch Pilots - 693

10. Hood Adjustment

1. Loosen hood attaching screws, three at each hood hinge, Fig. 11-8. Elongated holes in hinge provide fore, aft, and side adjustment of hood. Position hood so that tolerances shown in Fig. 11-10 are provided.

2. Tighten hinge to hood attaching screws on both sides.

3. Adjust rubber bumpers, located on each front fender front reinforcement, so that hood panel is flush with fenders at this point.

4. Adjust hood latch mechanism as described in Note 8.

11. Hood Hinge Spring— Removal and Installation

a. Removal (Fig. 11-8)

1. Open hood and prop as high as possible.
2. Using a strong wire hook, attach one end to center of pry bar of sufficient length and the other end to hinge spring.
3. With the aid of a helper, lift pry bar until spring disengages from hood hinge, then release pressure on bar slowly until spring is loose, then unhook other end of spring from hinge.

b. Installation (Fig. 11-8)

1. Hook one end of spring on hinge, then with the aid of a helper, use pry bar and wire hook to connect spring to front of hinge.

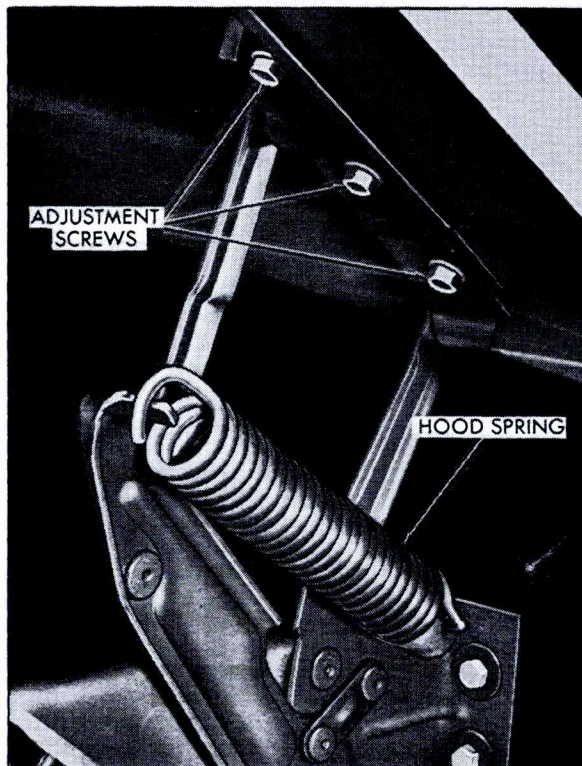


Fig. 11-8 Hood Hinge - 693

12. Front Fender (Right or Left)— Eldorado 693 Removal and Installation

a. Removal (Fig. 11-9)

1. Disconnect negative battery cable. If right fender is being removed, remove radio antenna as described in Section 15, Note 12a.

2. Raise front of car, and remove wheel at fender being replaced.

3. Disconnect wiring connectors for parking and turn signal and cornering and side marker lamps.

4. Open front door and remove two screws securing filler panel to hinge pillar and remove filler panel. Remove one screw with washer and shims securing fender to hinge pillar.

5. Remove fender attaching screw with washer and shims from top of cowl. Note number and arrangement of shims.

6. Remove three screws, washers and reinforcement plate securing fender to rocker panel. Note number and arrangement of shims.

7. Remove five screws securing fender to wheel housing at wheel opening.

8. Remove two screws and washers from inside wheel housing that hold fender to wheel housing at top.

9. Remove two screws and washers from radiator support area.

10. Remove screw securing lower support rod to radiator cradle, which is accessible underneath fender at front.

11. Apply masking tape to leading edge of door to avoid scratching finish during fender removal.

12. Remove fender from vehicle by lifting outward and slightly forward.

b. Installation (Fig. 11-9)

NOTE: All fender attaching bolts and screws should be loosely installed until alignment of fender is obtained. Then tighten to proper torque specifications. Loosen wheel housing attaching screws if necessary to align fender properly.

1. Position fender in approximate location, making sure wheel housing is in proper position at edge of fender.

2. Position rubber filler panel behind bumper.

NOTE: In the following steps, install proper number of shims necessary to obtain tolerances shown referring to Fig. 11-10.

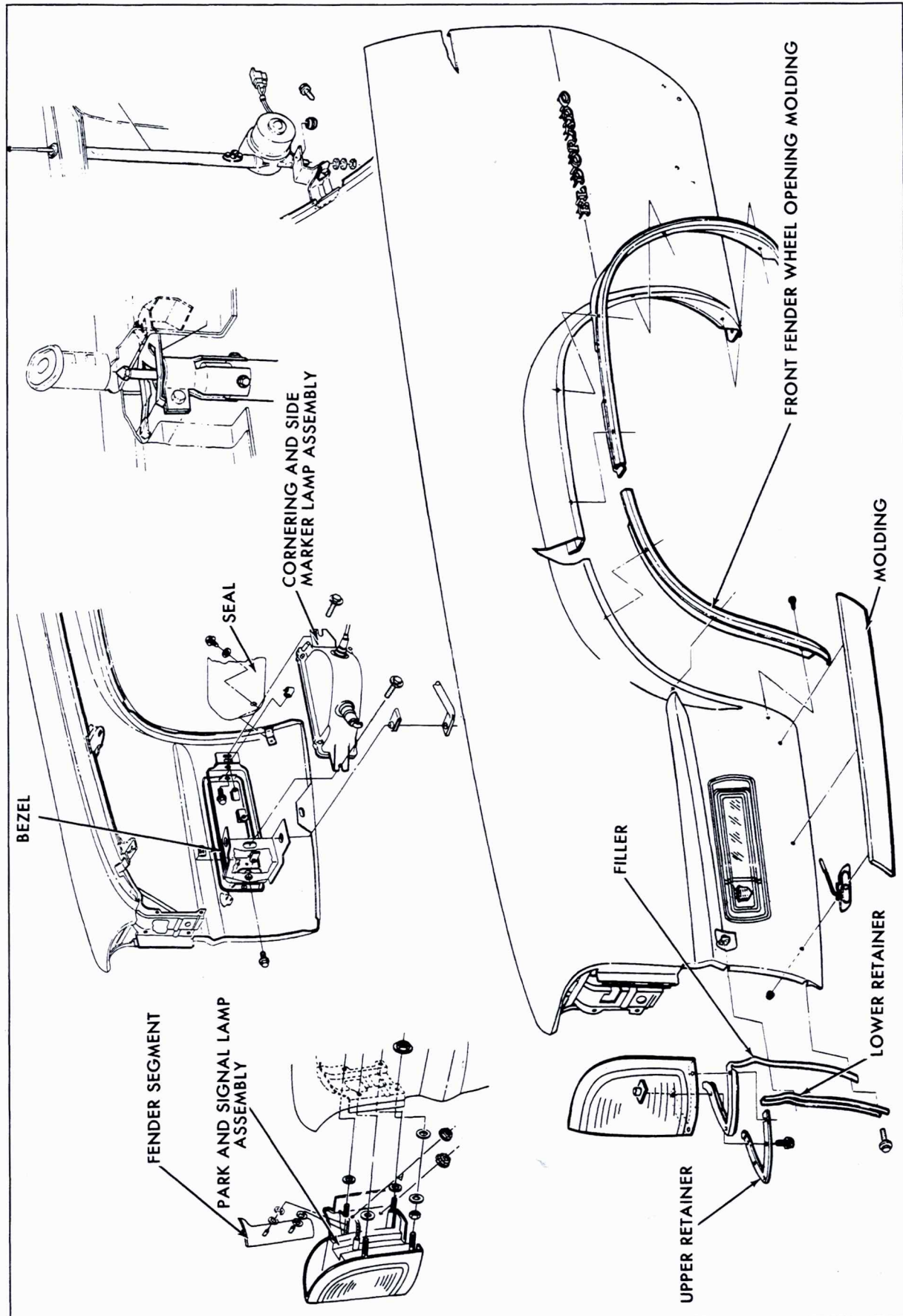
3. Install screw with washer at top of cowl securing fender to cowl.

4. Install three screws, washers and reinforcement plate securing fender to rocker panel.

5. Install two screws with washers securing fender to radiator cradle.

6. Install five screws securing wheel housing to fender at wheel opening.

7. Install two screws and washers that secure



wheel housing to fender at top of housing, working from inside fender.

8. Install screw with washer securing fender to door pillar in door hinge area.

9. Install screw securing lower support rod to radiator cradle.

10. Check alignment and tighten all screws to proper torque.

11. Connect wiring connectors for cornering and side marker lamp and turn signal and parking lamp.

12. Install wheel and lower car to ground.

13. Install radio antenna as described in Section 15, Note 12b, if removed.

14. Reconnect negative battery cable.

15. Remove masking tape from leading edge of door.

13. Front Fender Wheel Housing (Right or Left)—Eldorado 693 Removal and Installation

a. Removal

1. Remove fender as described in Note 12a.

2. Remove two bolts, nuts and flat washers holding cowl to wheel housing tie strut at wheel housing and position tie strut out of way.

3. Remove two screws securing hood hinge angle bracket to wheel housing.

4. If removing right hand wheel housing, proceed as follows:

a. Remove heater and A/C hoses from clip on wheel housing and support and position hoses out of way.

b. Remove nut, spacer, bolt and seat warmer tee (on cars with seat warmer).

c. Remove two bolts and nuts holding water control valve to wheel housing and position valve out of way (A/C only).

d. Disconnect wires from seat warmer relay on right wheel housing (seat warmer equipped cars only).

5. If removing left hand wheel housing, proceed as follows: Remove two screws securing vacuum storage tank to wheel housing (A/C only).

6. Remove wiring harnesses from wheel housing to avoid damage.

7. On cars equipped with Cruise Control, remove two screws and washers that secure Cruise Control power unit to wheel housing.

8. Remove two bolts with nuts, lock washers and flat washers securing wheel housing to radiator cradle at leading edge of wheel housing.

9. Remove three bolts with nuts and washers securing wheel housing to radiator cradle angle bracket.

10. Remove wheel housing from car.

b. Installation

1. Position wheel housing in approximate location.

2. Loosely install two screws securing hood

hinge to wheel housing.

3. Loosely install two bolts with nuts, lock washers and flat washers that secure wheel housing to radiator cradle at leading edge of wheel housing.

4. Loosely install three bolts with nuts, lock washers and flat washers that secure wheel housing to radiator cradle angle bracket.

5. Tighten bolts installed in steps 2 through 4.

6. Install wiring harnesses in their proper routings.

7. If installing right hand wheel housing, proceed as follows:

a. Install heater hoses under clip on wheel housing and support.

b. Install two bolts with nuts securing water control valve to wheel housing (A/C only).

c. Install nut, spacer, bolt and seat warmer tee (on cars with seat warmer).

d. Connect wires to seat warmer relay on right wheel housing (seat warmer equipped cars only).

8. If installing left hand wheel housing, install two screws securing vacuum storage tank to wheel housing (A/C only).

9. Install two screws and washers that secure Cruise Control power unit to wheel housing (Cruise Control cars only).

10. Install two bolts with nuts and flat washers that secure cowl to wheel housing tie strut at wheel housing.

11. Install fender as described in Note 12b.

14. Fuel Tank Filler Door—Eldorado 693 Removal and Installation

a. Removal

1. Open rear compartment lid.

2. Remove screw and ground wire for back-up lamp.

3. Disconnect feed wire.

4. Remove two screws and washers securing fuel tank filler door and remove door.

b. Installation

1. Position fuel tank filler door and loosely install two screws and washers.

2. Align door and tighten screws.

3. Connect feed wire for back-up lamp.

4. Install screw and ground wire.

15. Adjusting Sheet Metal Tolerances Eldorado 693 Body Clearances, Fig. 11-10

The adjustment procedures for clearances #1 through #11 (except #3, #4, #5 and #11), in Fig. 11-10 will be found in the 1969 Fisher Body Service Manual.

Clearances #3, #4, #5 and #11 should be adjusted by the procedures as outlined in Note 7a.

These clearances should be adjusted to the specifications shown in Fig. 11-10.

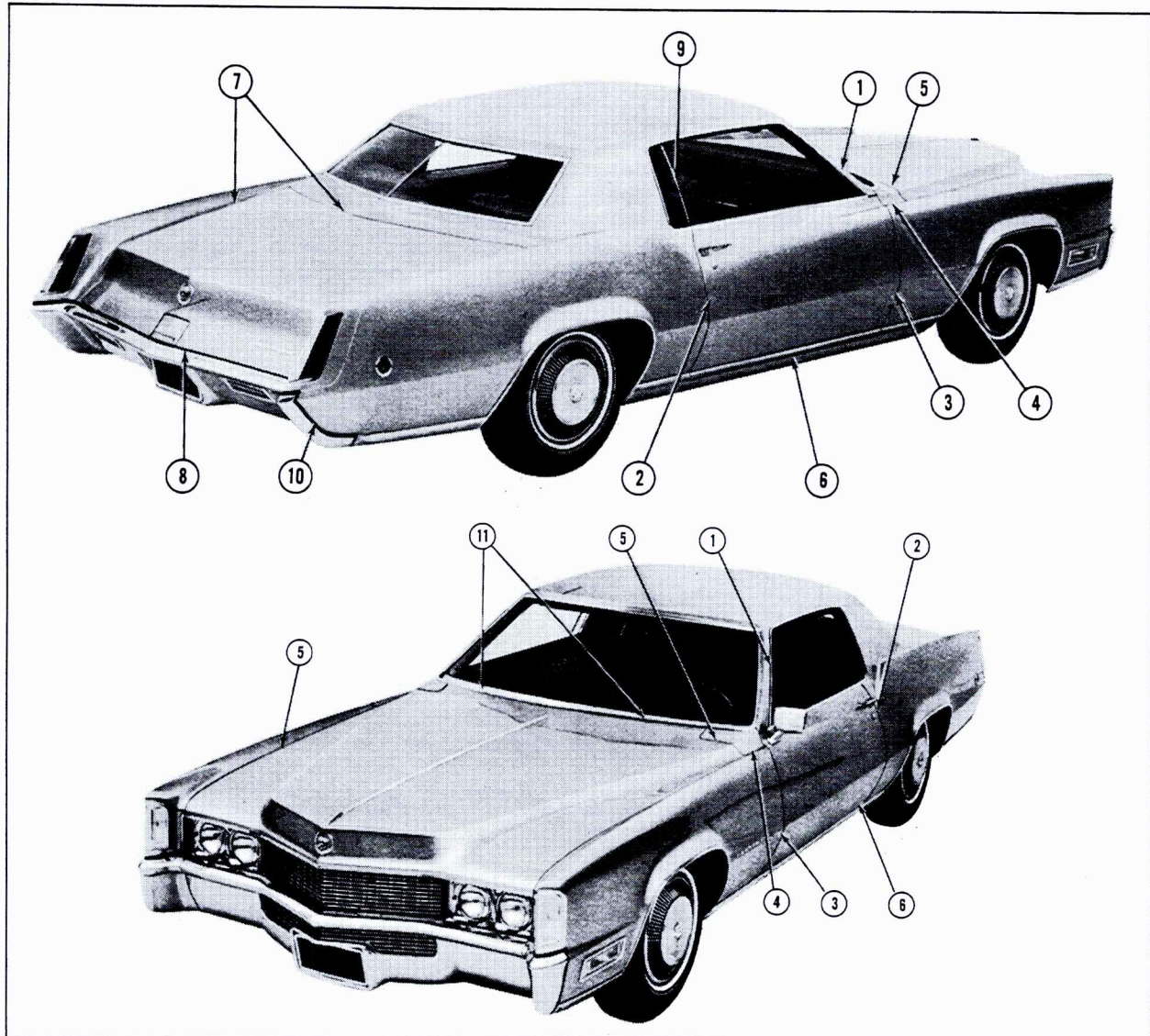


Fig. 11-10 Sheet Metal Tolerances - 693

SHEET METAL TOLERANCES—693

Location	Tolerance"	Flushness
1. Side window to windshield	3/8-7/16	—
2. Door to Quarter Panel	7/32-9/32	± 1/16
3. Door to Fender	1/8-1/4	± 1/16
4. Fender to Hood Panel Rear Extension	1/8-1/4	± 1/16
5. Hood to Fender or Hood Panel Rear Extension	3/32-5/32	± 1/16
6. Door to Rocker Panel	1/8-1/4	—
7. Trunk lid to Fender	1/16-1/4	± 1/16
8. Trunk lid to Bumper	5/16-7/16	—
9. Windows	5/16-3/8	*
10. Rear Bumper to Fender	1/2-3/4	—
11. Hood to Windshield Wiper Arm	1/8 Min.	—
*May be out of plane if weatherstrip provides watertight seal.		

TORQUE SPECIFICATIONS—693

Material No.	Application	Size	Foot Pounds
260M	Front Fender to Radiator Cradle	3/8-16	25
Special	Front Fender to Cowl	3/8-16	25
Special	Front Fender to Rocker Panel	3/8-16	25
Special	Front Fender to Hinge Pillar	3/8-16	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			